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CENTRAL AND SOUTHERN FLORIDA PROJECT: COMPREHENSIVE EVERGLADES RESTORATION PLAN C–111 SPREADER CANAL WESTERN PROJECT

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY, CIVIL WORKS, THE DEPARTMENT OF DEFENSE

TRANSMITTING

A REPORT ON THE AUTHORIZATION OF THE C–111 SPREADER CANAL WESTERN PROJECT

VOLUME 2 OF 5

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CENTRAL AND SOUTHERN FLORIDA PROJECT
COMPREHENSIVE EVERGLADES RESTORATION PLAN
C-111 SPREADER CANAL WESTERN PROJECT

FINAL INTEGRATED
PROJECT IMPLEMENTATION REPORT AND
ENVIRONMENTAL IMPACT STATEMENT

Volume 2 – Annexes A-B

January 2011

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C-111 SPREADER CANAL WESTERN PROJECT

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ANNEX A
FISH AND WILDLIFE COORDINATION ACT
AND ENDANGERED SPECIES ACT COMPLIANCE

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A.1 COORDINATION ACT REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

July 30, 2009

Colonel Al Pantano
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service Federal Activity Code: 41420-2006-FA-0283
Project: C-111 Spreader Canal,
Western Phase 1 Project

Dear Colonel Pantano:

The enclosed report is a final Fish and Wildlife Coordination Act (FWCA) Report on the C-111 Spreader Canal (C-111SC) Western Phase 1 Project for your review. This final FWCA report is based on the proposed action as described and analyzed in the U.S. Army Corps of Engineers' Draft Integrated Project Implementation Report (PIR) and Environmental Impact Statement (EIS) dated April 22, 2009, and the Revised Biological Assessment included in Annex A of that report. This final FWCA report provides the U.S. Fish and Wildlife Service's (Service's) continuing guidance and recommendations for the benefit of fish and wildlife resources in the C-111SC Project study area. This report is provided by the Service in accordance with the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). We are preparing a separate letter to fulfill requirements of section 7 of the Act for the C-111SC Project.

By copy of the draft FWCA Report dated March 16, 2009, the Service solicited comments from the Florida Fish and Wildlife Conservation Commission and the National Marine Fisheries Service. The Service also coordinated preparation of the draft and final FWCA Report with the National Park Service. This final report constitutes the Secretary of the Interior's recommendations for the C-111SC Project, in accordance with section 2(b) of the FWCA.

The Service continues to support this project, which in conjunction with the C-111 Spreader Canal Design Test Project and other Comprehensive Everglades Restoration Plan projects, will provide important information and progress towards restoration in Taylor Slough, the Southern Glades, Model Lands, and Florida Bay and provide a nexus for formulation of the C-111 Spreader Canal Eastern Phase 2 project. Collectively, these projects should provide benefits to fish and wildlife resources in the Everglades ecosystem and Florida Bay. We request that the Corps consider how to effectively sequence and implement these projects to expedite and maximize the benefits to natural resources. The analyses, conclusions, and recommendations contained in this final FWCA Report are contingent on information provided by the Corps and

South Florida Water Management District as of this date. The Service reserves the right to revise our recommendations based on new information or based upon any additional plan formulation, analyses and documentation that may occur prior to the final PIR and EIS.

If you or your staff have any questions regarding the findings and recommendations contained in this final report, please contact Richard Fike at 772-562-3909, extension 262. The cooperation of your staff and the staff of the South Florida Water Management District is greatly appreciated.

Sincerely yours,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc: w/enclosure (electronic copy only)
Biscayne National Park, Homestead, Florida (Sarah Bellmund)
Corps, Jacksonville, Florida (Rebecca Griffith, Michael Collis,
Raymond Wimbrough, Brad Tarr)
Corps, West Palm Beach, Florida (Tori White)
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NOAA Fisheries, Miami, Florida (Audra Livergood)
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Service, Jacksonville, Florida (Miles Meyer)

Fish and Wildlife Coordination Act Report

C-111 SPREADER CANAL, WESTERN PHASE 1 PROJECT
MIAMI-DADE COUNTY, FLORIDA

Submitted to:
Jacksonville District
U.S. Army Corps of Engineers
Jacksonville, Florida

Prepared by: Richard Fike
Reviewed by: Todd E. Hopkins, Miles Meyer and Pamela Repp
Approved by: Paul Souza, Field Supervisor

U.S. Fish and Wildlife Service
South Florida Ecological Services Office
Vero Beach, Florida

July 2009

EXECUTIVE SUMMARY

The C-111 Spreader Canal (C-111SC) Project is one of over 60 projects that are part of the Comprehensive Everglades Restoration Plan (CERP). The authorized plan for the C-111SC Project was originally described in the U.S. Army Corps of Engineers (Corps) Restudy document (Corps 1999) that was the basis for the authorized Plan. The project purpose for the C-111SC Project identified in the Restudy was to improve freshwater deliveries and enhance the connectivity and sheetflow in the Model Lands and Southern Glades areas, reduce wet season flows in the C-111 canal operated by the South Florida Water Management District (District), and decrease potential flood risk in southern Miami-Dade County. The primary system benefits were expected to include improved hydrologic connectivity in the Model Lands and Southern Glades. The secondary system benefits were expected to include improved salinity in the estuarine environment.

The proposed C-111SC Canal Project will be implemented in two phases or increments via Phase 1 and Phase 2 Project Implementation Reports (PIRs) (Western PIR and Eastern PIR, respectively). The Western PIR (Phase 1) hereafter referred to as the C-111SC Project, recommends a value-engineered version of Plan Formulation Alternative 2D (Alternative 2DShort) and is intended to improve the quantity, timing, and distribution of water delivered to central Florida Bay via Taylor Slough. The Eastern PIR (Phase 2) is intended to hydrate portions of the Southern Glades and Model Lands at shallow depth and low velocity by the construction of a full-scale spreader canal and other Eastern PIR features to be studied after the Western PIR is completed.

The project objectives for the C-111SC Project are to:

- Restore the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough to historical levels derived from the pre-drainage model runs;
- Improve hydroperiods and hydropatterns in the Southern Glades and Model Lands. The hydroperiods will be improved to optimal levels to support historical vegetation patterns as derived from the pre-drainage model runs. Hydropatterns will be restored to historical sloughs and associated tributaries.
- Return coastal zone salinities to historical, recorded conditions through the redistribution of water that is currently discharged to tide.

The Recommended Plan for the C-111SC Project includes the features associated with Alternative 2DShort, which provides opportunities to reduce the decision-critical uncertainties needed to recommend a full-scale spreader canal and other C-111SC Phase 2 (Eastern) features. Alternative 2DShort is intended to improve the quantity, timing, and distribution of water delivered to Central Florida Bay via Taylor Slough through the establishment of a hydraulic ridge between Taylor Slough and the C-111 canal, and to reduce seepage loss from Taylor Slough and its headwaters. The focus of this plan is to: (1) evaluate system-wide responses; (2) evaluate critical project uncertainties to changes in the intended reduction of seepage losses from Taylor Slough; (3) record ecological responses to these changes; and (4) evaluate the resulting flood control responses of the drainage system. Information gained from Phase 1 will provide valuable information for the planning and design of a spreader canal system to replace the existing C-111 canal.

The hydraulic ridge will be established by combining operational changes within the lower C-111 canal (south of S-177), and the diversion of water that is currently being discharged through the S-177, the S-18C and the S-197 to the existing Aerojet Canal, and an above ground infiltration basin, the Frog Pond Detention Area (FPDA), to be constructed within the District-owned Frog Pond lands. Marsh stage triggers in Taylor Slough, and elsewhere in the adjacent basin, will be used to manage pumping rates and the distribution of water to offset the seepage affects of the lower C-111 canal system. Creation of this hydrologic ridge will be accomplished by installation of additional intermediate water control structures on the lower C-111 canal and operational changes at S-18C and S-197 structures to increase the effective water control elevation of the lower C-111 canal. These intermediate structures and operational changes will facilitate reducing the seepage losses from Taylor Slough and increase the net water distributed west of the existing C-111 canal system.

In addition to the two features described above, Alternative 2DShort includes evaluation of operational changes at S-20 (both located on the L-31E canal), at least one and possibly two new operable structures in the lower C-111 canal just south of the existing S-18C structure, a plug at S-20A, and installation of ten plugs in the C-110 canal. This configuration of project components differs substantially from what was proposed in the Restudy.

The Service recognizes that a substantial effort has been required of the Project Delivery Team (PDT), often under demanding time constraints, to make considerable adjustments from the original project as it was conceived. The recommended plan embodies a foundation for completion of a multi-stage project which will include incremental implementation of operations, monitoring, and adaptive management to consider species and habitat restoration that maximizes overall project benefits and an iterative process feeding information learned into planning and implementation of Phase 2 for this project. The Service supports proceeding with the proposed project based on the planning documented to date in the draft PIR subject to any changes that may occur in the final PIR. The recommended project plan, as described, should provide meaningful hydrologic and ecologic improvements to the marshlands of Taylor Slough, the Southern Glades, Model Lands, and Everglades National Park (ENP). The proposed project should provide progress towards implementing an adaptive process that will facilitate improved management and understanding of hydrologic influences and salinity relationships in the near-shore waters of Florida Bay, Barnes and Card Sounds, and the adjacent coastal wetlands. Estuarine resources in the project area should be positively affected by the restoration of a more natural freshwater flow regime feeding the nearshore zone. However, the re-establishment of the salinity regime to realize a complete restoration of fish and wildlife resources throughout the nearshore zone in the project area will require much more freshwater than is currently available, particularly during the dry season. Although estuarine ecosystems are designed to withstand seasonal variations in salinity, the pulsing or inundation by freshwater or, alternately, the elimination of variability because of the reduction of freshwater input are harmful to the health of the system. Reduction of point source discharges at major conveyance canals as a result of implementing the C-111SC Project will reduce the unnaturally large fluctuations in salinity near canal mouths, resulting in more stable salinity regimes in these areas, which should improve habitat for fish and invertebrates inhabiting the areas near the canal outlets.

At the landscape level, completion of the C-111SC Project is important to the management and improvement of resource values of the adjacent conservation areas with Federal interest, such as ENP, Biscayne National Park, Florida Keys National Marine Sanctuary and Crocodile Lake National Wildlife Refuge. In addition to contributing to improving a wide ranging regional landscape for wildlife, the restoration area will conserve infiltration areas to benefit groundwater resources, affecting base flow to sloughs, other flowways, marshlands, estuarine and bay areas and help to prevent greater saltwater intrusion.

Recovery of federally threatened and endangered species would generally be fostered by improved habitat conditions in the project area as indicated by model output. Species listed as endangered under the Endangered Species Act of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). that may be encountered in or adjacent to the project area include: West Indian manatee (*Trichechus manatus*) and its designated critical habitat, wood stork (*Mycteria americana*), Florida panther (*Puma concolor coryi*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*) and its designated critical habitat, Cape Sable seaside sparrow and its designated critical habitat, smalltooth sawfish (*Pristis pectinata*), crenulated lead-plant (*Amorpha herbacea* var. *crenulata*), and tiny polygala (*Polygala smallii*). Species listed as threatened that may be encountered in or adjacent to the project area include: the American crocodile (*Crocodylus acutus*) and its designated critical habitat, eastern indigo snake (*Drymarchon corais couperi*), Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*), roseate tern (*Sterna dougallii dougalii*), and Garber's spurge (*Chamaesyce garberii*).

Throughout the planning for this project, the District and Corps have been in informal consultation with the Service. Formal consultation under the Act was initiated on April 22, 2009. Implementation of the project may benefit several federally listed species by improving freshwater flow to a variety of habitat types that will result in corresponding beneficial responses throughout the ecosystem. Progress towards lowering salinity in the coastal wetlands should increase productivity of prey fish, thus providing an increase in the forage base for wood storks and State-listed wading birds. Lower salinities in the coastal wetlands should also make the habitat more suitable for hatchling and juvenile crocodiles. However, there will likely be some short-term and small-scale negative impacts to listed species, such as, disruption of local feeding areas due to project construction activities, and to habitat for the Cape Sable seaside sparrow that may experience extended hydroperiods exceeding its optimal range. The West Indian manatee may experience periodic localized reduction in freshwater flow in the C-111 canal below S-197 (in an area that they have been documented to frequent) that may precipitate some redistribution of manatee use in estuarine coastal areas.

The Service has concerns about the benefits that will be provided by the proposed plan, given the changed scope of the project compared to what was envisioned in the Restudy. We are concerned that the project has been divided into two phases, and we are concerned that Phase 2 may not be implemented for reasons such as land availability and Federal and State budget uncertainties. We recommend that Phase 2 be planned and implemented as soon as possible. We also recommend that additional planning, implementation, evaluation, and monitoring for Phase 1 be conducted with the intent to provide information for planning and improved implementation of Phase 2, as well as optimizing mutually beneficial aspects of the two phases.

The Service is also concerned about the lack of available freshwater for the project to fully realize the conceptualized project benefits. As other features of the CERP are designed and operated, water management protocols for C-111SC Project components need to be reconsidered. This may include provisions for a future increase in water availability, storage capacity and treatment, and modification of operations for elements of the selected plan to benefit Florida Bay, its coastal wetlands, and the Southern Glades, that are consistent with the C-111SC Phase 1 and Phase 2 goals and objectives.

Given the uncertainties inherent in modeling provided as part of planning for this project and the high level of uncertainty of the effects from implementing the proposed project, the implementation of sound monitoring and adaptive management plans are vital to project success. The Service recommends close adherence to the water quality and ecological monitoring plans developed for the C-111SC Project, including the ecological monitoring specified in the Restoration Coordination and Verification (RECOVER) Monitoring and Assessment Plan and the project-level monitoring plans appearing in the PIR. The Service also recommends that an adaptive management plan be developed for the project and implemented to maximize the restoration success of the project and to provide valuable information for the planning and construction of Phase 2 of the project.

The spatial scope of the C-111SC Project envisioned by the Restudy was redirected to maximize restoration aspects of Taylor Slough and Florida Bay. An increment of progress towards this restoration may be accomplished in Phase 1 with some potential impacts to the Cape Sable seaside sparrow and marshland habitat areas in the lower C-111 canal in the ENP panhandle area. While the project has diminished significantly in scale of anticipated benefits from what was originally envisioned, the Service continues to support the project as an important first step in restoring the project study area marshlands, near shore waters of Florida Bay and the adjacent coastal wetlands. However, the Service encourages the Corps and District to seek opportunities and creative means to more fully achieve the extent of restoration in the C-111SC study area envisioned by the Restudy during Phase 2 of the C-111SC Project.

Analysis of the Modbranch model used to simulate effects of implementation of the recommended plan indicates that there could potentially be a negative effect on the habitat of the Cape Sable seaside sparrow, particularly subpopulation D. As much as 22 percent of the critical habitat in subpopulation D will be affected by extension of the hydroperiod beyond the range that is conducive to growing vegetation utilized by sparrows for nesting. Spatial analysis further reveals that some of the acreage that may be affected is outside areas presently being utilized by sparrows. In addition, the model indicates that there are other habitat areas, both within and outside of designated critical habitat that may in the with-project model scenario be benefited and characteristic of the desired hydroperiod window needed for sparrow nesting habitat maintenance. Combined with the inherent uncertainties, both in model output accuracy and the nature of project effects subject to implementation and operation, monitoring necessary to determine overall effects on the Cape Sable seaside sparrow is tenuous at best at this time. Enhanced monitoring, safeguards based on incremental test stage operations, and development of a Cape Sable seaside sparrow management plan including habitat enhancement activities offers the best opportunity to better understand project effects in the project study area and formulate safeguards and management measures to the overall benefit of the sparrow population.

Prior to initiating project operations, further analysis of project effects on hydrologic conditions in Cape Sable seaside sparrow critical habitat in subpopulations C and D should be conducted to facilitate preparation of operational plans that consider sparrows and other species and habitats to enhance overall project benefits. Creation of specific trigger cells, located at key locations at verified ground elevations, would help improve restoration and address uncertainty in the current modeling output. All operation schedules should consider project structure operations during time periods key to sparrow life history requirements and broader benefits to fish and wildlife resources. Monitoring of hydroperiod, water depth and vegetative community composition needs to be an integral part of the baseline and post construction and operation ecological monitoring plan not only in sparrow habitat areas, but all areas of the project study area affected by hydrological changes.

Due to changes indicated by model output, the Service recommends that current annual vegetation surveys be continued, and that additional transects be monitored in critical habitat areas and expanded to areas where hydroperiod changes could potentially benefit sparrows and to better monitor areas that may currently be utilized by Cape Sable seaside sparrows. These surveys should include transects that include observations of vegetation, periphyton, soils, and topography. Critical habitat within the project study area should have fine-scale ground elevation surveys performed to facilitate a better understanding of sparrow habitat conditions and project operations as well as enhancing the ability to protect important sparrow habitat.

We recommend that the Corps and District prepare and implement a Cape Sable seaside sparrow management plan for the C-111SC Project study area in consultation with the Service. This plan would include identification of potential sparrow habitat expansion outside of designated critical habitat areas, recommended management and monitoring, and other possible habitat enhancement measures both within critical habitat and in potential expansion areas, and should consider woody vegetation removal, fire management, and creation of sawgrass refugia.

Environmental assessments in the C-111SC Project area have revealed contamination of soils in some areas. In some cases, the contamination detected is at a level that is toxic to fish and wildlife. Endosulfan is present within ENP along the eastern boundary adjacent to the L31N and C-111 canals, in the Loveland Slough, at S-178 and the C-111E canal. Assessments of acute and chronic risk to aquatic organisms from endosulfan exposure, especially endosulfan sulfate, singly or in combination with other pesticides, are not favorable and show significant risk at several freshwater sites in the C-111 canal and at estuarine sites in Florida Bay (Carriger et al. 2006; Carriger and Rand 2008a, 2008b).

The detected levels of contaminants, specifically copper, in the FPDA present a concern for Service trust resources, including the endangered Everglade snail kite, migratory birds, and resident wildlife species. Sampling of ambient contaminant levels dispersed throughout the project footprint has now been conducted and the District is proposing to conduct soil scraping to reduce contaminants to acceptable levels given proposed FPDA operations and projected short inundation duration. The Service has concurred with the recommendation to conduct soil scraping provided that post-scraping confirmatory sampling be conducted on a representative percentage of the project site. Confirmatory sampling should include a measure of the relative percent of soil remaining and the concentration of copper within these soils. These data should be used to calculate an estimated area-weighted average for the entire FPDA. Once these confirmatory samples are collected, determination of monitoring needs or further remediation can be made. It is recommended that if Frog Pond soils are to be reused in the construction of berms, that they pass all leachability testing criteria.

To date, Modbranch modeling indicates that in an average year up to 90 acres (ac) of the FPDA could be inundated for a longer duration than the remainder of the FPDA (80 days or longer) at an average depth of 1 foot (ft). These conditions could sustain a short hydroperiod wetland vegetation community and its associated fauna, which have the potential for contaminant uptake and bioaccumulation. To prevent potential contaminant exposure to fish and wildlife resources, additional corrective actions may be needed.

The quality of water in the C-111E canal has potential for disrupting the ecology of marsh areas receiving inflows. Contaminants detected by past monitoring studies of the C-111E canal include metals (*e.g.*, lead, chromium, cadmium, zinc, and copper) and pesticides (*e.g.*, atrazine, endosulfan, and DDT). Invertebrates and fish in the S-178 have the highest potential risk of acute effects from surface water endosulfan exposure and of chronic effects from porewater compared to any other location in the C-111 canal and estuarine zones (Carriger and Rand, 2008a, 2008b). Pumping operations that are part of the C-111SC Design Test Project (proposed to test spreader canal feasibility on a small scale) and future full-scale spreader canal implementation in Phase 2 could potentially result in this poor quality water entering surrounding marshes. The Service recommends that planning for the C-111SC Water Quality Pilot Project (proposed to test feasibility of water quality treatment technologies) be resumed and the proposed project implemented (after an analysis of feasibility), with the proper safeguards for construction, operations, and monitoring regime.

Contaminants including selenium, chlordane, lead, and other toxics have been documented at levels of concern in soils within the potential footprint and effects area of the C-111SC Design Test Project and the proposed future full scale C-111 Spreader Canal as part of Phase 2. Additional sampling was conducted and evaluated in May, 2006 over a more refined impact area of the Design Test Project with more accurate laboratory detection limits. This analysis showed that the originally detected contaminant levels were unlikely to pose ecological risk upon flooding and that the study area was suitable for the purpose of the proposed Design Test Project. To prevent potential contaminant exposure to fish and wildlife resources, corrective actions may still be needed in the larger scale spreader canal implementation if the project proceeds in the footprint which was analyzed. The Service's Environmental Contaminants staff will continue to review the assessment reports, and based upon the potential risk indicated by limited soil sampling and food chain modeling, the Service will provide specific recommendations for corrective actions and monitoring to the District.

The Service recommends that the Corps, District, and the C-111SC PDT work collaboratively to develop a water quality monitoring plan and sampling points for both surface and groundwater that may include new well points or monitoring locations at areas of concern (such as the FPDA feature, the Aerojet Canal feature, the C-111 Design Test project, and the C-111SC Phase 2 proposed full scale spreader canal potential corridor) and additional parameters sampled to adequately assess environmental risk. If contaminants are found during project monitoring at levels that exceed those established by the Environmental Protection Agency to protect aquatic life (U.S. Environmental Protection Agency 2002) the Corps should modify project operation and monitoring accordingly and coordinate with the Service and other stakeholders.

The recommendations provided here are intended to make this project more environmentally compatible and to further enhance the diversity and abundance of fish and wildlife resources in the project area, while assuring that maximum ecological benefits are delivered to Florida Bay and adjacent coastal wetlands consistent with the basic project purpose. The recommendations described above are designed to minimize potential adverse impacts to fish and wildlife resources from the proposed action.

The Service reiterates its support for the C-111SC Project recommended plan as a first step in restoring freshwater wetlands and the near shore waters of Florida Bay and the adjacent tidal wetlands. Even though the spatial extent of wetland restoration envisioned by the Restudy will not be realized by the proposed project, the redistribution of freshwater across the study area to a more natural flow should improve ecological conditions within the project area.

The Service appreciates the cooperation of the C-111 Spreader Canal PDT in responding to our concerns and recommendations throughout the planning process. We remain committed to assist in addressing our remaining recommendations to further enhance fish and wildlife resources as detailed project plans are reviewed and the project is constructed, and we look forward in providing assistance to planning and implementing Phase 2 of the C-111 Spreader Canal Project.

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LIST OF ACRONYMS AND ABBREVIATIONS

ac	acres
Act	Endangered Species Act
ATV	All Terrain Vehicle
BA	Biological Assessment
BAF	Bioaccumulation Factor
BBCW	Biscayne Bay Coastal Wetland
C&SF	Central and Southern Florida
C-111SC-1	C-111 Spreader Canal Project Phase 1
CERP	Comprehensive Everglades Restoration Plan
cm	centimeters
COPEC	Chemicals of Potential Environmental Concern
Corps	U.S. Army Corps of Engineers
CSSS	Cape Sable seaside sparrow
dBA	Decibel (A Scale)
DEP	Florida Department of Environmental Protection
District	South Florida Water Management District
EIS	Environmental Impact Statement
ENP	Everglades National Park
EPA	U.S. Environmental Protection Agency
EPOC	Emerging Pollutant of Concern
ESA	Environmental Site Assessment
FDOT	Florida Department of Transportation
FIU	Florida International University
FPDA	Frog Pond Detention Area
FPDB	Frog Pond Detention Basin
FPL	Florida Power and Light
ft	foot
FWC	Florida Fish and Wildlife Conservation Commission
FWCA	Fish and Wildlife Coordination Act
GDM	General Design Memorandum
GRR	General Re-evaluation Report
GDM	General Design Memorandum
GIS	Graphical Information System
ha	hectares
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram
km	kilometer
m	meter
mg	milligram
MWD	Modified Water Deliveries
NGVD	National Geodetic Vertical Datum
NOAA Fisheries	National Marine Fisheries Service

NPS	National Park Service
PAL	Planning Aid Letter
PCA	Project Cooperation Agreement
PDT	Project Delivery Team
PIR	Project Implementation Report
ppb	parts per billion
ppt	parts per trillion
RECOVER	Restoration Coordination and Verification
Service	U.S. Fish and Wildlife Service
SESE	Southeast Saline Everglades
SIdepth	Suitability Index - Depth
SIrecession	Suitability Index - Recession
SIWB	Wading Bird Suitability Index
SFWMM	South Florida Water Management Model
SSC	Species of Special Concern
SLERA	Screening Level Ecological Risk Assessment
SMPP	Seepage Management Pilot Project
TP	Total Phosphorus
UCL	Upper Confidence Limit
USDA	U.S. Department of Agriculture
WCA	Water Conservation Area
WMA	Wildlife Management Area
WRDA	Water Resources Development Act

I. PURPOSE, SCOPE, AND AUTHORITY

A. Introduction

The purpose of this Fish and Wildlife Coordination Act (FWCA) Report is to evaluate the existing conditions and identify the environmental effects of the proposed C-111 Spreader Canal Western Phase 1 Project. For purposes of this report, all further reference to the project Phase 1 will be referred to as the C-111SC Project, unless specifically referenced as Phase 1 or Phase 2. The goal of the C-111SC Project is to improve the quantity, timing, and distribution of water delivered to Central Florida Bay via Taylor Slough. It is anticipated that these improvements can be realized through the establishment of a hydraulic ridge between Taylor Slough and the C-111 canal, to reduce seepage from Taylor Slough and its headwaters.

B. Purpose and Scope of Project

The C-111SC Project is 1 of over 60 projects that are part of the Comprehensive Everglades Restoration Plan (CERP). The authorized plan for the C-111 Spreader Project was originally described in Sections 9.1.8.26, C-111N Spreader Canal (WW) and Section 10.6.2.7, C-111N Spreader Canal of Volume 1 of the "Yellow Book". The Yellow Book comprises ten volumes and is the Restudy document (Corps 1999) that was the basis for the authorized Plan. The project map as it appears in the Yellow Book is shown as Figure 1. Within the Yellow Book, the project purpose for the C-111 Spreader was to improve freshwater deliveries and enhance the connectivity and sheetflow in the Model Lands and Southern Glades areas (Figure 2), reduce wet season flows in C-111 canal, and decrease potential flood risk in southern Miami-Dade County (Figure 1). The primary system benefits were expected to include improved hydrologic connectivity in Model Lands and Southern Glades. The secondary system benefits were expected to include improved salinity in the estuarine environment.

The proposed C-111 Spreader Canal Project will be implemented in two phases or increments via Phase 1 and Phase 2 Project Implementation Reports (PIRs) (a Western PIR and Eastern PIR respectively). The Western PIR (Phase 1) represents a value engineered version of Plan Formulation Alternative 2D and is intended to improve the quantity, timing, and distribution of water delivered to Eastern Florida Bay via Taylor Slough. The Eastern PIR (Phase 2) is intended to hydrate portions of the Southern Glades and Model Lands at shallow depth and low velocity by the construction of a full-scale spreader canal and other Eastern PIR features to be studied after the Western PIR is completed.

C. Authority

The authority for this project is contained within the Water Resources Development Act (WRDA) 2000. Section 601(b) (A) of WRDA states:

(b) Comprehensive Everglades Restoration Plan Approval –

(A) IN GENERAL. —Except as modified by this section, the Plan is approved as a framework for modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, and the improvement of the environment of the South Florida ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan and required pursuant to this section, for as long as the project is authorized.

The initial, conditional authorization of the C-111SC as one of the ten initially authorized projects is contained in Section 601(b)(2)(C), WRDA 2000, which states:

> (2) Specific Authorizations. –
>
> > (C) Initial Projects. – The following projects are authorized for implementation, after review and approval by the Secretary, subject to the conditions stated in subparagraph (D), at a total cost of $1,100,918,000, with an estimated Federal cost of $550,459,000 and an estimated non-Federal cost of $550,459,000:
>
> (x) C-111 Spreader Canal, at a total cost of $94,035,000, with an estimated cost of $47,017,500 and an estimated non-Federal cost of $47,017,500.

II. FISH AND WILDLIFE RESOURCES IN THE PROJECT AREA

A. Major Habitat Zone Description

The C-111 Spreader Canal Project Delivery Team (PDT) has investigated the habitat types and vegetation zones utilizing a variety of analytical techniques including field investigations, analysis of aerial photography, hydrological records, literature review, and historical documentation. For purposes of the analysis conducted using the Modbranch modeling post-processing to feed into benefits calculations and performance criteria the PDT separated the project study area into indicator regions that integrated vegetative ecological zones with physical features that effect hydrology (roads, canals, levees, sloughs, etc.) (Figure 4). Table 1 provides a list of vegetation common to each vegetative ecological zone, and Table 2 describes the vegetation community type (*i.e.*, shrub dominated forested wetland) and acreages including Taylor Slough, bays and sounds.

The following discussion of major habitat zones is organized according to categories of habitat types that are important for wildlife within each zone.

1. Taylor Slough

Taylor Slough (Figure 5) is the second largest drainage basin in Everglades National Park (ENP), extending from the northeastern edge of ENP to Florida Bay. It occupies a broad depression in the Miami oolite bedrock with the center of the depression deeper than the margins. Lower

Taylor Slough is filled with peat up to 2 meters (m) thick that supports a mosaic of willow-sawgrass marshes, evergreen shrub islands, and open sparse rush marshes. The eastern and western imprecisely defined margins support sawgrass, rush, or a mixture of both. Peat also occurs in bedrock depressions in the lower part of the slough, which is otherwise covered with marl soil. The marl flats are generally covered with a thick periphyton mat, an assemblage of microalgae that thrives on shallow submersed substrates and is commonly associated with precipitated calcite. This thick periphyton mat may cover the submersed stems of macrophytes in addition to forming a layer on the sediment or a floating mat on the water surface and presents resistance to flow through the slough in addition to that provided by vegetation.

Taylor Slough was historically the major conduit for freshwater flow to Florida Bay (McIvor et al. 1994). In recent history, surface water flow into the slough has been markedly reduced by upland water management practices and presently the majority of upland flows into the slough are controlled inputs from a series of water control structures on the L-31W and C-111 canals managed by the District. The western boundary of Taylor Slough is a slightly higher ridge that separates it from Shark River Slough. The southern levee along the lower section of the C-111 canal north of the ENP panhandle has been degraded as part of restoration efforts, allowing water to flow into wetlands south of the C-111 canal towards Florida Bay. As this water flows south towards the bay, it becomes increasingly channelized and drains into five major creek systems, McCormick Creek, Taylor River, Mud Creek, Trout Creek, and West Highway Creek that then discharge to Florida Bay. At the interface of the wetland and bay, the creeks cut through Buttonwood Ridge, an area of relatively high topographical relief. This makes the five creeks major point sources of freshwater to Florida Bay due to the restriction of overland flow of water by the ridge.

2. Marl Prairie

This particular ecosystem is a unique mix of prairie ecology and wetland habitat. It is found in areas of thin calcitic soil with a limestone bedrock base. Marl prairie landscapes occupy higher-elevation sites within a mosaic that consists of a mixture of wet prairie, sawgrass, tree islands, and tropical hammock communities (Olmstead and Loope 1984). Marl prairies have the shortest hydroperiods of the Everglades (2 to 9 months) (Lodge 2005); under present conditions, many sites east of Shark River Slough are dry for an average of 9 months per year (Van Lent et al. 1993; Fennema et al. 1994). The short hydroperiods and shallow water depths that characterize marl prairies result in accumulation of a calcitic mud substrate rather than a peat substrate, and periphyton assemblages are dominated by calcite-encrusting, filamentous cyanobacteria such as *Scytonema* and *Schizothrix* (Browder et al. 1994; Davis et al. 2005). These studies referenced the optimal hydroperiod to be for 3 to 7 months, the shortest of all marsh types. The marl prairie is found on either side of the main water flow that defines the Everglades. The properties of the marl result in slow seepage of the flowing water as opposed to full drainage. The dominant feature of marl prairie habitat is the presence of grasses of varying size and composition. The most common is sawgrass, which does not grow very high (tall) in most areas. However, the areas of taller sawgrass growth almost always occur in areas with a longer hydroperiod. Marl prairies have high plant diversity, with approximately 100 different species (Lodge 2005), of which approximately half are grasses and sedges (Porter 1967), and the dominant species depends on hydroperiod: sites with 1 to 2 month hydroperiods are dominated by *Schizachyrium rhizomatum* (Florida little bluestem), sites with 3 to 5 month hydroperiods are dominated by *Muhlenbergia* (muhly grass), and sites with 6 to 8 month hydroperiods are dominated by *Cladium* (sawgrass) (Olmstead and Loope 1984; Davis et al. 2005). The combination of low-stature herbaceous ground cover and extended dry periods has fostered development of specialized faunal assemblages that are closely tied to the habitat, including the Cape Sable seaside sparrow (CSSS) (*Ammodramus maritimus*), macroinvertebrates, herpetofauna, and wading birds. Marl prairie is an important feeding area for wading birds, especially in the dry season. Organisms such as crayfish and amphibians, which do not require permanent surface water, are normally found in the marl. However, in areas where there are many solution holes, a number of organisms such as small fish and the Florida apple snail (*Pomacea paludosa*), may be found that survive in the standing water found in the solution holes during the dry season.

Throughout the habitat, interspersed between the grasses, is a carpet of dried periphyton. Periphyton is a complex mix of different algal species, and is an important food source for marsh organisms. Some marl prairie sites contain very small tree islands. On the periphery of the marl prairie, there are a few larger tree islands composed of slash pine and other species including the bald cypress.

3. Sawgrass

Sawgrass (*Cladium jamaicense*) is a common plant species forming a dominant community type in the project study area. Contrary to its name, sawgrass is a rhizomatous, perennial sedge rather than a grass and it is well adapted to the variable conditions including flooding and burning that occur in the Everglades system. It can survive variable water depths, varying from dry soil to flooding of the lower portions of the plant; however, it is subject to mortality if high water levels occur over an extended period (Davis 1989; Hofstetter and Parsons 1979; Herndon et al. 1991). An adaptation that facilitates its dominance in the oligotrophic waters in some areas of the Everglades is the low nutrient requirement of sawgrass (Steward and Ornes 1975). It is also well adapted to fire, and while its leaves are extremely flammable, the plant normally survives burning because the meristem is protected by inflammable spongy tissue except under extreme drought (Craighead 1971; Forthman 1973; Hofstetter and Parsons 1979; Wade et al. 1980). Regrowth to preburn height and density can occur within 2 years following a fire if the meristem is intact (Forthman 1973; Tilmant 1975; Loveless 1959).

Sawgrass marsh occurs in two characteristic types within the Everglades based upon the soil depth; sawgrass is either tall and dense or short to intermediate with more scattered density. Sites with peat soils greater than 1 m support taller sawgrass which can be up to 3 m in height. The taller sawgrass community is more typically found in the Taylor Slough area. At sites with shallow, less organic soils, sawgrass grows in much shorter scattered stands. This sawgrass community type is more characteristic in the marl soils of the study area.

4. Mangrove

Mangrove forests are found in the coastal channels and winding rivers around the tip of south Florida. The term "mangrove" does not signify a particular botanical relation, but rather, is used to identify several species of salt-tolerant trees that thrive amidst the harsh growing conditions of the coast. Red mangroves (*Rhizophora mangle*), identified by their stilt-like roots, and the black (*Avicennia germinans*) and white mangroves (*Laguncularia racemosa*) thrive in tidal waters, where freshwater from the Everglades mixes with saltwater. All three species grow in oxygen-poor soil, can survive drastic water level changes, and are tolerant of salt, brackish, and fresh water.

Mangrove trees are well adapted to the transitional zone of brackish water where fresh water meets salt water. During the wet season freshwater is abundant and empties into Florida Bay. In the dry season, and particularly in extended periods of drought, saltwater creeps inland into the coastal prairie, an ecosystem that buffers the freshwater marshes by absorbing sea water. Red mangroves have the farthest-reaching roots, trapping sediments that help build coastlines after and between storms. ENP boasts the largest contiguous stand of protected mangrove forest in the hemisphere.

This mangrove estuary system is a valuable nursery for a variety of recreationally and commercially important marine and estuarine species. During the dry months, wading birds congregate here to feed and nest. During the summer months, these mangrove forests absorb the energy of waves and storm surges providing the first line of defense against the howling winds and storm surge of hurricanes.

5. Forested Wetlands and Tree Islands

Forested wetlands in the project study area are the highest elevation natural habitat, described in Tables 1 and 2 and illustrated in Figure 4 as ecological zone 2 (shrub dominated freshwater marsh). The highest elevations include invasive species such as Brazilian pepper (*Schinus terebinthifolius*) or Australian pine (*Casuarina* spp.) mixed with or dominating the canopy. Lower elevations are dominated by native species such as dahoon holly (*Ilex cassine*), red bay (*Persea palustris*), sweet bay (*Magnolia virginiana*), and willow (*Salix caroliniana*). Shrubby or forested patches alternate with herbaceous wetlands dominated by sawgrass but well mixed with other wetland species. This area was mapped by Egler (1952) as part of Band 3 (sawgrass dominated wetlands), but he described a drier variant at higher elevations that had much higher numbers of species present. Egler (1952) discussed the effects of drainage and fire suppression on this region and it is currently thought that both impacts and disturbance from a history of farming in many areas have contributed to the dominance of woody species. Due to the diversity and cover afforded by the multidimensional shrub and tree cover, this habitat zone is important habitat for a wide variety of wildlife species including small mammals, endemic and migratory birds, and reptiles. The Florida panther (*Puma concolor coryi*) has been documented from telemetry records of tagged animals to frequent this area.

Small islands of trees growing on land elevated between 1 foot (ft) and 3 ft above sloughs and prairies are also called tropical hardwood hammocks. They may range from 1 to 10 acres (ac) in area, and appear in freshwater sloughs, sawgrass prairies, or pineland. Hammocks are slightly elevated on limestone plateaus raised several inches above the surrounding peat, or they may grow on land that has been unharmed by deep peat fires. Hardwood hammocks exhibit a mixture of subtropical and hardwood trees, such as Southern live oak (*Quercus virginiana*), gumbo limbo (*Bursera simaruba*), and bustic (*Dipholis salicifolia*) that grow in very dense clumps. Near the base, sharp saw palmettos (*Serenoa repens*) flourish, making the hammocks very difficult for people to penetrate, though small mammals, reptiles, and amphibians find these islands an ideal habitat. Water in sloughs flows around the islands creating moats. Though some ecosystems are maintained and promoted by fire, hammocks may take decades or centuries to recover; the moats around the hammocks protect the trees. The trees are limited in height by weather factors such as frost, lightning, and wind; the majority of trees in hammocks grow no higher than 55 ft.

6. White Zone

A common feature of many south Florida coastal areas is a zone of low plant cover, clearly recognizable as a white band on black and white or color infrared photos, sandwiched between more densely vegetated fringing mangrove and interior ecosystems. Egler (1952) described such a "white zone" midway within the Southeast Saline Everglades (SESE), a broad expanse of marine, brackish, and fresh water wetlands extending south and east from the Atlantic Coastal Ridge (Figure 4, Table 2). The white zone is a region of low productivity characterized by low vegetation cover and canopy height (< 50 percent and < 1 m, respectively). From remotely sensed images, it appears as a reflective white band, resulting mainly from its sparse cover of low-growing plants, in conjunction with the reflective quality of the exposed marl soils or the fresh storm deposits that cover them and, in some areas, periphyton.

The majority of the white zone corresponds with the supratidal region of the coast, which is irregularly flooded by tidal waters. Some areas, however, are more regularly inundated by semi-diurnal tides. Over the past 50 years, the interior boundary of the white zone has encroached inland by an average of 1.5 kilometers (km). Maximum shifts occurred in areas cut off from upstream fresh water input by canals (1.8 km at Turkey Point) (Ross et al. 2002).

Ross et al. (2002) examined historical changes in SESE coastal wetlands over the past 5 decades and found minimal change in the position of the white zone in Taylor Slough and north of Long Sound, but marked landward shifts north of Joe Bay, in the triangular area between Card Sound Road and U.S. Highway 1, and south of Turkey Point. They attributed this pattern to differences in connection to upstream fresh water sources, because the latter three basins were cut off or had reduced availability of water as a result of water management activities, while water supply to the first two basins remained high during the period. Surprisingly, the plant species composition of the expanded white zone had also changed in the almost half-century since the earlier study, *i.e.*, there was a general increase in the relative abundance of mangroves, and reduced occurrence of graminoids more commonly associated with brackish or fresh water conditions (Ross et al. 2002).

Egler (1952) examined the transitional character of its vegetation, which included both the graminoid elements from the interior marshes and dwarf mangrove forms from the coastal swamps. He concluded that the mixture of interior and coastal taxa in the white zone reflected a balance between several types of disturbance. For instance, the periodic occurrence of fire and freezing temperatures were postulated as limitations to the invasion of the fire- and cold-sensitive mangrove species into the interior. In contrast, major tidal events associated with hurricanes and tropical storms disperse mangrove propagules well into the interior, and may raise soil salinities above the tolerance of some freshwater species.

While the position of the sparsely vegetated white zone may provide a reliable indicator of the extent of marine influence, the gradient in plant species composition responds independently to the same coastal influences. Since the physical appearance of the white zone is linked to biotic pattern it can be used to indicate environmental change. Salt water reaches the interior of the white zone only during spring tides and storms, and even much of its coastal portions are not wetted regularly by the semi-diurnal tides. Once tidal waters do enter the white zone, they drain slowly and unevenly, tending to pool in local depressions, where they evaporate over days or weeks. By April of a dry year, the process may result in both surface desiccation and saline or hypersaline porewater. These environmental conditions contrast sharply with those encountered during the fall months, when the combination of high tides and heavy rains often cause persistent flooding with fresh or brackish water. While certain plants may grow reasonably well in one or the other of these conditions, adaptations which allow them to persist in both may require physiological tradeoffs which result in reduced productivity (Ball 1988). White zone soils in much of the SESE are marls of the Perrine series, which are silt loam in texture (U.S. Department of Agriculture 1996). These are heavy marl soils that may contribute to phosphorus limitation, and present both physical and chemical impediments to plant growth. Because of their heavy texture, they drain slowly, and therefore may undergo long periods of anaerobiosis. Additionally, due to their calcareous nature and high pH (typically 7.4 to 7.8), phosphorus availability may be limited (Ross et al. 2002).

B. Fish and Wildlife Resources

The C-111SC Project study area includes a variety of habitat types, both aquatic and terrestrial. Native habitat for fish and wildlife comprises only part of the project study area due to drainage, water management activities, urbanization, rock mining, and exotic plant infestations. Although degraded wetlands, agricultural fields and pastures, levees, canals, rock quarry lakes, and exotic vegetation have replaced wetland habitat in the remainder of the study area, they do provide fish and other aquatic and terrestrial wildlife with habitat. In addition, these areas provide attractive foraging habitat for birds during seasonal precipitation and water fluctuations.

Conditions within the project area likely provide important resources for opportunistic small animals including raccoons, rabbits, squirrels, songbirds, hawks, kestrels, crows, vultures, frogs, and various reptiles. White-tailed deer, alligators, various fish species, and wading birds have been observed in the study area. The greatest species richness is found within ENP. The agricultural areas provide only partial benefits to resident wildlife. Many of the native fish found in marshy areas of the C-111SC Project study area are small, minnow sized species. The dominance of smaller fish species is due to differential mortality during drying periods, when the smaller fish are at an advantage. In addition, smaller species have the ability to reproduce, grow, and expand their numbers rapidly as water levels rise and marshes re-flood. If water levels become stabilized over a longer period of time or in canals and larger water bodies, larger fish survive and become dominant, and may be found within the project study area. A wide variety of invasive fish species may also be found within the canal and other areas. Other common wildlife include invertebrates such as the apple snail (*Pomacea paludosa*), common pond snail (*Physa spp.*), grass shrimp (*Paleomonetus paludosus*), and crayfish; and a wide variety of insects including dragonflies, damselflies, butterflies, beetles, waterbugs and others too numerous to list.

Table 3 provides a more extensive list of commonly occurring fish and wildlife species (not protected under the Act) in the C-111SC study area (Florida Fish and Wildlife Conservation Commission [FWC] 2003; Service 2002; Dalrymple and Dalrymple 1996; Myers and Ewel 1990).

1. Federally Listed and Candidate Species

Species listed as endangered under the Act and that may be encountered in or adjacent to the project area include: West Indian manatee (*Trichechus manatus*) and its designated critical habitat, wood stork (*Mycteria americana*), Florida panther (*Puma concolor coryi*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*) and its designated critical habitat, CSSS and its designated critical habitat, smalltooth sawfish (*Pristis pectinata*), crenulated lead-plant (*Amorpha herbacea* var. *crenulata*), and tiny polygala (*Polygala smallii*). Species listed as threatened and that may be encountered in or adjacent to the project area include: the American crocodile (*Crocodylus acutus*) and its designated critical habitat, eastern indigo snake (*Drymarchon corais couperi*), Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*), roseate tern (*Sterna dougallii dougalii*), and Garber's spurge (*Chamaesyce garberii*). The bald eagle (*Haliaeetus leucocephalus*) has been delisted under the Act but continues to be protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act.

Florida Panther

The Florida panther, a subspecies of mountain lion, is one of the most endangered large mammals in the world. The most recent population estimate for the Florida panther is 80 to 100 individuals, not including denning kittens (McBride et al. 2008). This small population in south Florida represents the only known remaining wild population of an animal that once ranged throughout most of the southeastern United States from Arkansas and Louisiana eastward across Mississippi, Alabama, Georgia, Florida, and parts of South Carolina and Tennessee. The panther presently occupies a contiguous system of large private ranches and public conservation lands in Collier, Hendry, Lee, and Monroe Counties totaling more than 2 million ac including Big Cypress National Preserve, ENP, Florida Panther National Wildlife Refuge, Okalacochee Slough, the Fakahatchee Strand, numerous private ranches and a variety of other public and private lands. Geographic isolation, habitat loss, population decline, and associated inbreeding have resulted in a loss of genetic variability and overall health of the Florida panther population. Natural gene exchange ceased when the panther became geographically isolated from other subspecies of *Puma concolor* (Seal 1994).

Panthers are associated with the remaining pine rocklands, pine flatwoods, and other forested and non-forested vegetation communities in a mosaic of habitat types in south Florida. Within the Everglades system, panthers primarily occur on uplands, including tree islands, levees, and upland plant communities, though they do use freshwater marshes, primarily those in close proximity to upland communities (Service 1999). The landscape of south Florida that supports the Florida panther consists of a diversity of land uses and land cover types. With the exception of urban areas and open water, panthers have used the broad spectrum of available habitats for hunting, resting, breeding, travel, denning, and dispersal. Our conservation efforts focus on landscape-level habitat protection and management that preserves existing panther social/breeding units and provides opportunities to establish additional units (Florida Panther Subteam 2002).

The Florida Panther Subteam of the Multi-species/Ecosystem Recovery Implementation Team created a potential habitat model for the Florida panther as part of their work (Florida Panther Subteam 2002). This model was based on the following criteria; forest patches greater than 2 hectares (ha), non-urban cover types less than 200 meters (m) from forest patches, and exclusion of lands less than 300 m from urban areas. The potential habitat map was reviewed in relation to telemetry data, satellite imagery available as of 2002, and panther home range polygons; boundaries were drawn around lands defined as the Primary Zone (Kautz et al. 2006), the most important area needed to support a self-sustaining panther population (Figure 6). Panthers use the landscape in such a way (through home range behaviors, social interactions, characteristic movement and dispersal patterns, and prey dependencies) that make land in and contiguous to the Primary Zone essential for both survival and growth of the population.

Protecting habitat in and contiguous with the Primary Zone on both public and private land and maintaining connectivity and areal extent of the Primary Zone has been identified as a high priority for Florida panther recovery. To achieve a self-sustaining panther population it is important to establish landscape linkages and protect habitat to maintain and restore connectivity from the Primary Zone to potential or suitable habitat within the rest of the historic range of the Florida panther. Isolated tracts of land, regardless of quality, must be large enough to host a breeding population of panthers and be well connected by broad corridors of suitable landscape, allowing for successful gene flow, dispersals, and replacement when mortalities occur (Florida Panther Subteam 2002).

The C-111SC study area is within the designated Primary Zone of the Panther Focus Area (Figure 6) (Service 2006a). An analysis of Florida panther radio-telemetry data has shown considerable historic panther activity within the C-111SC Project study area (Figures 7 and 8) and with respect to land cover reveals that panthers prefer forested cover types as daytime rest sites. They also utilize other natural and disturbed cover types for feeding, breeding, and shelter, as long as patches of forest with understory are present in the landscape. The habitat types located within the project study area including flooded woody vegetation, mixed shrubs, freshwater marsh, sawgrass marsh, hardwood hammocks (tree islands), and areas with exotic vegetation are occasionally used by Florida panthers. Levee areas may also be used by Florida panthers (Service 1999).

The Florida Panther Habitat Preservation Plan (Logan et al. 1993) identified the Model Lands Basin within the C-111SC Project area, located south of the urban area of Florida City and east of U.S. Highway 1, as important panther habitat that would provide connectivity between ENP, Crocodile Lake National Wildlife Refuge, the Southern Glades Wildlife and Environmental Area, and Biscayne National Park, and recommended preservation of 31,000 ac. Figure 7 shows the telemetered locations of Florida panthers that are currently alive and documents less recent telemetered panther activity in the project area compared to Figure 8 that shows all telemetered panther locations between 1981 through 2008. However, two relatively recent panther mortalities along the western edge of the Model Lands provide evidence that the project site may still occasionally be used by dispersing panthers. Panther UCFP80 was killed by a motor vehicle on Card Sound Road on February 2, 2006, and panther UCFP96 was killed by a vehicle on U.S. Highway 1 just south of Card Sound Road on May 9, 2007. The FWC telemetry data indicates that panther #21 utilized a large portion of the Model Lands Basin between the Florida Power and Light's (FPL) Turkey Point Power Plant cooling canals and Card Sound Road in 1988.

West Indian Manatee and Designated Critical Habitat

The West Indian manatee, or sea cow, is a large, plant-eating aquatic mammal that can be found in the shallow coastal water, rivers, and springs of Florida in both fresh and salt water habitats. Florida is essentially the northern extent of the West Indian manatee's range, though some manatees occasionally are reported from as far north as Virginia and the Carolinas. Manatees frequently move into riverine and canal systems and migrate throughout the waterways in south Florida (Service 1999). They depend on areas with access to natural springs or manmade warm water refugia and access to areas with abundant aquatic vascular plants, their primary food source. The majority of documented manatee sightings in the project study area have been in the C-111 canal system below the S-197 structure (Figure 9). All of the canals within the C-111SC Project study area are accessible to manatees (Service 2006b) (Figure 10).

The West Indian manatee is designated as an endangered species by both the Service and FWC. West Indian manatees are also protected under the provisions of the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1461 *et seq.*), as well as Florida law.

West Indian manatees occur throughout Florida Bay, Barnes and Card Sounds, and all other embayments found in the C-111SC Project study area, but are most frequently observed in tributaries and near-shore seagrass beds (Service 2001). The extensive acreages of seagrass beds in the bays provide foraging areas for manatees. Manatees also depend upon canals as a source of freshwater and as resting sites. The relatively deep waters of the canals respond more slowly to temperature fluctuations at the air-water interface than the shallow bay waters. Thus, the canal waters remain warmer than open bay waters during the passage of winter cold fronts and manatees use the deeper canals as a cold-weather refuge. Manatees are present year-round, but are most abundant in winter.

The project area overlaps designated critical habitat for the West Indian manatee (35 FR 8495; June 2, 1970) which includes "all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee, and Buttonwood Sounds between Key Largo, Monroe County, and the mainland of Miami-Dade County".

Everglade Snail Kite and Designated Critical Habitat

The Florida population of snail kites is considered to be a single population that often shifts its distribution within its range in response to climatic variations that effect foraging and nesting conditions. The combination of a range restricted to the watersheds of the Everglades, Lakes Okeechobee and Kissimmee, and the Upper St. Johns River, with a highly specific diet composed almost entirely of apple snails, makes the snail kite's survival directly dependent on the hydrology and water quality of these watersheds. Each of these watersheds has experienced, and continues to experience, pervasive degradation due to urban development, agricultural activities, and recent drought (Service 1999; Service 2004a; Martin et al. 2006a).

Snail kite habitat consists of freshwater marshes and the shallow vegetated edges of lakes (natural and man-made) where apple snails can be found. These habitats occur in humid, tropical ecoregions of peninsular Florida and are characterized as palustrine-emergent, long-hydroperiod wetlands often on an organic peat substrate overlying limestone or sand or directly on limestone or marl (Service 1999). Suitable foraging habitat for the Everglade snail kite is typically a combination of low profile (less than 3 ft) marsh with an intermixed matrix of shallow (0.65 to 4 ft deep) open water, which is relatively clear and calm. The interspersed emergent vegetation enables apple snails, the kite's primary food source, to climb near the surface to feed, breathe, and lay eggs.

Non-breeding snail kites use communal roosts throughout the year. Roosting sites are almost always located over water typically in willow (*Salix caroliniana*), melaleuca, or pond cypress (*Taxodium ascendens*) near suitable foraging areas. Snail kite breeding (nest building) can occur throughout the year, but primarily occurs from January to May (December through July includes all periods when active nests are known), depending on the water level of the nesting area (Bennetts and Kitchens 1997). Nesting almost always occurs over water most commonly in small trees such as willow, melaleuca, and pond cypress, but can also occur in herbaceous vegetation such as sawgrass, cattail (*Typha* spp.), giant bulrush (*Scirpus validus*), and reed (*Phragmites australis*). Preferred nesting sites are typically more than 500 ft from uplands to protect against predators (Sykes 1987). Nesting substrate must be close to foraging habitat, so extensive areas of contiguous woody vegetation are generally unsuitable for nesting. Snail kites primarily forage within 1,640 ft of the nesting site (Sykes 1987).

The C-111SC study area contains no designated critical habitat for the snail kite. Snail kites have been documented foraging and moving through the C-111SC study area (Service 1999). In dry years, the snail kite depends on water bodies remote from regularly used sites, which normally are suboptimal for feeding, such as canals, impoundments, or small marsh areas. The protection of these areas is important to the survival and recovery of the snail kite (Takekawa and Bessinger 1989; Bennetts and Kitchens 1997; Service 2004a; Martin et al. 2006). It is possible that snail kites forage in the canals and wetlands adjacent to the project site. Snail kite nesting does not occur randomly within wetland systems. Instead, there are generally areas within wetlands, where kite nesting is concentrated. The density of kite nests, frequency of nesting within each area, and the sizes of these "priority kite nesting areas" (Service 2006c) are highly variable. In most years, the majority of kite nesting will occur within these areas, though new nesting areas may become active. At the end of each nesting season, primary kite nesting areas are being delineated by the Service, based on the current year's nest locations and nesting in the previous 10 years (Service 2006c).

Wood Stork

In south Florida, breeding colonies of the wood stork occur in Broward, Charlotte, Collier, Miami-Dade, Hardee, Indian River, Lee, Monroe, Osceola, Palm Beach, Polk, St. Lucie, and Sarasota Counties. Wood storks have also nested in Martin County and, at one time or another, in every county in south Florida. It is believed that storks nesting in north Florida, Georgia, and South Carolina move south during the winter months (December through February). The number of storks feeding in the three Water Conservation Areas (WCAs) of the central and northern Everglades varied greatly among winters, ranging from a low of 1,233 birds in a high-water year to 7,874 birds in a low-water year (Service 2004b). In most of the study years, 1985 to 1989, the total number of storks in the WCAs increased substantially between December and January, and dropped off sharply after March. In some years, the inland marshes of the Everglades have supported the majority (55 percent) of the United States population of wood storks (Service 1999). The Southeast United States breeding population of the wood stork is increasing and expanding its overall range. Population and productivity criteria for reclassification have been met with 3-year population averages of 6,000 nesting pairs and productivity of 1.5 chicks per nest per year. Delisting criteria of 10,000 nesting pairs (5-year average) have not been achieved.

The wood stork is primarily associated with freshwater and estuarine habitats for nesting, roosting, and foraging. Wood storks typically construct their nests in medium to tall trees that occur in stands located either in swamps or on islands surrounded by relatively broad expanses of open water (Service 2004b). During the non-breeding season, or while foraging, wood storks occur in a wide variety of wetland habitats. Typical foraging sites for the wood stork include freshwater marshes and stock ponds; shallow seasonally flooded roadside or agricultural ditches; narrow tidal creeks or shallow tidal pools; managed impoundments; and depressions in cypress heads and swamp sloughs (Service 1999). Because of their specialized feeding behavior, wood storks forage most effectively in shallow-water areas with highly concentrated prey (Service 2004b). In south Florida, low, dry-season water levels are often necessary to concentrate fish to densities suitable for effective foraging by wood storks (Service 2004b). As a result, wood storks will forage in many different shallow wetland depressions where fish become concentrated, either due to local reproduction by fishes or as a consequence of seasonal drying.

Wood storks prefer to construct nests in tall trees surrounded by open water or within marshes and swamps (Service 1999). During the non-breeding season, wood storks are found throughout Florida, with interchange between populations within the State as well as between states. The wood stork was federally listed as endangered in February 1984, and is also listed as endangered by the State of Florida. No critical habitat has been designated for this species.

None of the C-111SC study area is within the Primary or Secondary Nesting Zones for known wood stork colonies (Service 2004b). Potential nesting habitat does exist in the study area in tropical hardwood hammock, hardwood swamp, shrub swamp, and exotic plant habitat types. All of the project study area is within the core foraging area of documented wood stork nesting colonies located outside the project area south of Tamiami Trail and in ENP (Figures 11 and 12).

Cape Sable Seaside Sparrow and Designated Critical Habitat

General Background

The CSSS is one of eight extant subspecies of seaside sparrow in North America. Its distribution is limited to the short-hydroperiod wetlands at the bottom of the greater Everglades system, on the southern tip of mainland Florida. The CSSS is a medium-sized sparrow, 5.1 to 5.5 inches (in) (13 to 14 centimeters [cm]) in length. Unlike most other subspecies of seaside sparrow, which occupy primarily brackish tidal systems (Post and Greenlaw 1994), the CSSS currently occurs primarily in the short-hydroperiod wet prairies, also referred to as marl prairies. The CSSS is generally sedentary, secretive, and is non-migratory, occupying the marl prairies of southern Florida year-round. During the breeding season (March to August), male sparrows establish and defend territories that are variable in size, ranging from 0.7 to 16.8 ac (0.3 to 6.8 ha) (Werner 1975), with reported average sizes ranging from 2.2 to 8.9 ac (0.9 to 3.6 ha) within different sites and years (Werner and Woolfenden 1983, Pimm et al. 2002).

Breeding and Nesting Behaviors

Sparrows are thought to be monogamous (Post and Greenlaw 1994), with a single female occurring within a male's breeding territory. However, recent information indicates that sparrows may be polygamous under some circumstances, such as within small populations, and it is unknown whether the birds are simultaneously or sequentially polygamous (Lockwood et al. 2006). Throughout the breeding season, the majority of a sparrow pair's activities occur within this territory, including breeding, feeding, and sheltering. Within an area of suitable habitat, territories do not appear to be tightly packed (Werner 1975), and there are gaps between defended boundaries of adjacent males. It is likely that sparrows venture into these 'unclaimed areas" during the breeding season.

Sparrows generally begin nesting in early March (Lockwood et al. 2001), but may begin territorial behavior, courtship, and nest-building in late February (Werner and Woolfenden 1983;

Lockwood et al. 1997). This timing coincides with the dry season, and most areas within the marl prairies are either dry or only shallowly inundated at the beginning of the breeding season. During the dry portion of the breeding season (March to May), sparrows build nests above the ground, but relatively low in the vegetation (6.7 to 7.1 in [17 to 18 cm]) above the ground (Werner 1975; Lockwood et al. 2001). Nests are woven into clumps of dense vegetation and are well-concealed (Werner 1975; Post and Greenlaw 1994). Nest cups are consistently concealed from above (Post and Greenlaw 1994), either through construction of a domed cover or through modifying vegetation in the vicinity (Werner 1975; Post and Greenlaw 1994). During the wet portion of the sparrow breeding season (June to August), sparrows build their nests higher in the vegetation than during dry periods, an average of 8.3 in (21 cm) above the ground surface (Lockwood et al. 2001). Wet-season nests probably occur in taller vegetation than during the dry season because even at the nest height, there must be sufficient height and density of vegetation to cover and conceal nests.

Pimm et al. (2002) suggest that nesting will not be initiated if water levels are at a depth greater than 10 cm during the breeding season. For many years, rising water levels resulting from the onset of summer rains were thought to end the breeding season (Werner 1975). While these statements are true, the sparrows may respond to changes in hydrologic conditions as long as water levels are not prohibitively high. Large rainfall events early in the wet season may cause some nest failure and sparrows generally cease breeding when water levels rise above the mean height of the nests from the ground (Lockwood et al. 1997; Basier et al. 2008; Cade and Dong 2008). However, if water levels subsequently drop, sparrows may again initiate breeding activity. The initiation of molt, which usually occurs in early September, is probably the best indicator of the true end of breeding season.

The sparrow nesting cycle, from nest construction to independence of young, lasts about 30 to 50 days (Werner 1975; Lockwood et al. 2001), and sparrows may renest following both successful and failed nesting attempts (Werner 1975; Post and Greenlaw 1994; Lockwood et al. 2001). Both parents rear and feed the young birds and may do so for an additional 10 to 20 days after the young fledge (Woolfenden 1956, 1968; Trost 1968). They are incapable of flight until they are about 17 days of age; when approached flightless fledglings will freeze on a perch until the threat is less than a 3 ft (1 m) away, and then run along the ground (Werner 1975; Lockwood et al. 1997).

Because of the long breeding season in southern Florida, sparrows regularly nest several times within a year, and may be capable of successfully fledging 2 to 4 clutches, though few sparrows probably reach this level of success (Lockwood et al. 2001). Second and third nesting attempts may occur during the early portion of the wet season, and nests later in the season usually occur over water.

Nest success rates vary among years, and range from 12 to 53 percent (Lockwood et al. 2001). Nest predation is the primary cause of nest failure that is documented (Pimm et al. 2002), accounting for more than 75 percent of all nest failures (Lockwood et al. 1997; Basier et al.

2008). As water levels begin to rise above ground surface with the onset of the summer rains in May to June, nest predation rates also rise. Nests that are active after June 1, when water levels are above ground, are more than twice as likely to fail as nests during drier periods (Lockwood et al. 2001; Basier et al. 2008; Cade and Dong 2008). This effect appears to be a result of both increased likelihood of nests being flooded and an increased likelihood of predation (Lockwood et al. 1997, 2001; Pimm et al. 2002).

Outside of the breeding season, sparrows generally remain sedentary in the general vicinity of their breeding territories, but expand the area that they use compared to the breeding season territory (Dean and Morrison 2001). Average non-breeding season home range size was about 42.1 ac (17.1 ha) in size, and ranged from 14.1 to 137.1 ac (5.7 to 55.5 ha) (Dean and Morrison 2001). Some individuals make exploratory movements away from the area of their territories, and may occasionally relocate their territories and home ranges before resuming a sedentary movement pattern (Dean and Morrison 2001).

Sparrow subpopulations require large patches of contiguous open habitat (about 4,000 ac or larger). The minimum area required to support a population has not been specifically determined, but the smallest area that has remained occupied by sparrows for an extended period is this size. Individuals are area-sensitive, and generally avoid the edges where other habitat types meet the marl prairies. They will only occupy small patches of marl prairie (less than 100 ac) vegetation when they occur within large, expansive areas and are not close to forested boundaries (Dean and Morrison 2001). Once sparrows establish a breeding territory, they exhibit high site fidelity, and each individual sparrow may only occupy small area for the majority of their lives. Because sparrows are generally sedentary and avoid forested areas, they are not likely to travel great distances to find mates or to find outlying patches of suitable habitat. The occurrence of sparrows over time within each of the subpopulations shows a centrality, in which sparrows most consistently occur and are most abundant near the center of the patch of habitat in which they occur.

Within a patch of occupied suitable habitat, sparrow breeding territories do not generally saturate the entire area. Even when sparrows occur at high densities, small areas usually remain between adjacent territories, though some territories also appear to overlap. In addition, some gaps remain unclaimed by territorial birds that may appear to be suitable habitat (Werner 1975). In many cases, areas that appear to be suitable for sparrow occupancy may not be suitable during certain environmental conditions and this may cause sparrow territories to appear to be widely separated from neighboring territories.

Sparrows are generally short-lived, with an average individual annual survival rate of 66 percent (Lockwood et al. 2001). The average lifespan is probably 2 to 3 years. Consequently, a sparrow population requires favorable breeding conditions in most years to be self-sustaining, and cannot persist under poor conditions for extended periods (Lockwood et al. 1997; Lockwood et al. 2001; Pimm et al. 2002).

Feeding Behavior

While detailed information about the diet of sparrows is not known, invertebrates comprise the majority of their diet, though sparrows may also consume seeds when they are available (Werner 1975; Post and Greenlaw 1994). Howell (1932) identified the contents of 15 sparrow stomachs and found remains of primarily insects and spiders, as well as amphipods, mollusks, and plant matter. Primary prey items that are fed to nestlings during the breeding season include grasshoppers (Orthoptera), moths and butterflies (Lepidoptera), dragonflies (Odonata), and other common large insects (Post and Greenlaw 1994; Lockwood et al. 1997). Adult sparrows probably consume mainly the same species during the nesting season. Sparrows may consume different proportions of different species over time and among sites, suggesting that they are dietary generalists (Pimm et al. 2002). During the non-breeding season, preliminary information from evaluation of fecal collections suggests that a variety of small invertebrates, including weevils and small mollusks are regularly consumed (Dean and Morrison 2001). Evidence of seed consumption was only present in four percent of samples (Dean and Morrison 2001). These non-breeding season samples may not be representative of the foods most frequently consumed during that season and may only represent a portion of the items ingested.

While the sparrow appears to be a dietary generalist, an important characteristic of sparrow habitat is its ability to support a diverse array of insect fauna. In addition, these food items must be available to sparrows both during periods when there is dry ground and during extended periods of inundation. The specific foraging substrates used are unknown, but they probably vary throughout the year in response to hydrologic conditions.

Sheltering Behavior

Sparrows inhabiting the C-111SC Project study area occur mostly within the short-hydroperiod freshwater marl prairies of the southern Everglades that flank the deeper sloughs. The most commonly associated species in freshwater habitats occupied is muhly grass (*Muhlenbergia filipes*) (Werner 1975; Kushlan and Bass 1983; Werner and Woolfenden 1983; Post and Greenlaw 1994). However, a variety of vegetation species occurs within the freshwater marl prairies occupied by sparrows, including habitat from which *Muhlenbergia* is absent (Ross et al. 2006). Other dominant species that occur in these prairies include sawgrass (*Cladium jamaicense*), (*Schizachyrium rhizomatum*), black-topped sedge (*Schoenus nigricans*), and beak rushes (*Rhynchospora* spp.) (Werner and Woolfenden 1983; Ross et al. 2006).

Sparrows occupy these communities year-round, and the vegetation must support all sparrow life stages. During periods when the communities are dry, usually coinciding with the late winter and early spring (December to May), sparrows traverse the ground surface beneath the grasses, and only occasionally perch within the vegetation. During the wet season (June to November), the ground surface is inundated, with peak water depths occasionally exceeding 2 ft (0.6 m) (Nott et al. 1998). During these periods, sparrows travel within the grasses, perching low in the clumps, hopping among the bases of dense grass clumps, and walking over matted grass litter. During the wet season sparrows fly more frequently, and regularly perch low in the vegetation, but generally remain inconspicuous (Dean and Morrison 2001).

Small tree islands and individual trees and shrubs occur throughout the areas occupied by the sparrows, but at a very low density. Sparrows do not appear to require woody vegetation during any aspect of their normal behavior, and generally avoid areas where shrubs and trees are either dense or evenly distributed. However, the small tree islands and scattered shrubs and trees may serve as refugia during extreme environmental conditions, and may be used as escape cover when fleeing from potential predators (Dean and Morrison 2001). Because of their general aversion to dense trees and woody vegetation, encroachment of trees and shrubs quickly degrades potential habitat.

Hydrologic conditions have significant direct and indirect effects on sparrows. First, depth of inundation within sparrow habitat is directly related to the sparrow's ability to move, forage, nest, find shelter, and avoid predators and harsh environmental conditions. Average annual rainfall in the Everglades is about 56 in (142 cm) per year (ENP 2005), with the majority of this falling within the summer months, which coincides with the latter half of the sparrow nesting season. This rainfall has a strong influence on the hydrologic characteristics of the marl prairies. However, throughout southern Florida, including sparrow habitat, hydrologic conditions are also influenced by water management actions. The operation of a system of canals, levees, pumps, and other water management structures, can have wide-ranging impacts on the hydrologic conditions throughout much of the remaining marl prairies (Johnson et al. 1988; Van Lent and Johnson 1993; Pimm et al. 2002).

At water levels over 2 ft (0.6 m) above ground surface, the majority of the vegetation in sparrow habitat is completely inundated, leaving sparrows with limited refugia. Conditions such as these may result in significant impacts to sparrow survival, and if they occur during the breeding season, these water levels will cause flooding and loss of sparrow nests (Nott et al. 1998; Pimm and Bass 2002). Even more moderate water levels, in the range of 6 inches (15 cm) above ground surface, may inundate enough habitat that sparrows cannot find shelter and are restricted in their movements. These water levels, when they occur during the nesting season, result in increased rates of nest failure due to predation (Lockwood et al. 1997; Basier et al. 2008). While elevational variation within the Everglades is small, differences in elevation as small as 1 ft (30 cm) can result in different habitat characteristics.

The vegetation species composition and density in the Everglades are largely influenced by hydroperiods. Hydroperiods that range from 60 to 270 days support the full variety of vegetation conditions that are generally suitable for sparrows (Ross et al. 2006), though the vegetation composition and structure may vary significantly. Persistent increases in hydroperiod may result in changes in vegetation communities from marl prairies or mixed prairies to sawgrass-dominated communities resembling sawgrass marshes (Nott et al. 1998). Detailed studies relating hydroperiod characteristics to sparrow habitat have concluded that an average annual discontinuous hydroperiod range (average number of days in a year that water stage is above ground level) of 60 to 180 days is optimal for the plant species important for sparrow nesting and for maintenance of sparrow habitat (Olmsted 1980; Kushlan et al. 1982; Kushlan 1990; Wetzel 2001; Ross et al. 2006).

Conversely, areas that are subjected to short hydroperiods generally have higher fire frequency than longer-hydroperiod areas (Lockwood et al. 2003, Ross et al. 2006), and are readily invaded by woody shrubs and trees (Werner 1975; Davis et al. 2005). Both an increased incidence of fire and an increased density and occurrence of shrubs detract from the suitability of an area as sparrow habitat.

The local variability across the landscape within areas where sparrows occur produces a heterogeneous arrangement of different vegetation conditions that all provide habitat for sparrows during some environmental conditions. A complex relationship between hydrologic conditions, fire history, and soil depth determine the specific vegetation conditions at a site, and variation in these characteristics may result in a complex mosaic of vegetation (Taylor 1983; Ross et al. 2006). This variability is characteristic of the habitats that support sparrows.

Population Surveys

The use of helicopters to facilitate larger scale surveys for the CSSS was first accomplished in 1974 (Werner 1975). The first comprehensive, range-wide CSSS survey was conducted in 1981 and was not repeated until 1992. Since this time, surveys have been conducted annually including twice in 2000 (Pimm et al. 2002). Over this time period, there have been substantial changes in most of the six subpopulations (Table 4). The 1981 sparrow survey provided a good baseline on the distribution and abundance of sparrows at that time, and the 1992 survey results were remarkably similar, though there is no information available about how the population may have changed over the intervening 12 years.

In 1981, there were an estimated 6,656 sparrows distributed across the six subpopulations, with most of the sparrows occurring within three large subpopulations (A, B, and E), and three smaller subpopulations (C, D, and F) (Table 4). Subpopulations B, C, and D occur within the C-111SC Project study area. When first surveyed, subpopulation B contained an estimated 2,352 sparrows inhabiting the marl prairies southeast of Shark River Slough near the center of ENP. Subpopulation B remains one of the most abundant subpopulations, with estimated size remaining relatively stable around 2,000 birds (Table 4). From 1981 to 2008, estimated population sizes have ranged from 1,888 to 3,184 birds. Subpopulation C, located in the vicinity of Taylor Slough and along the eastern boundary of ENP, and subpopulation D, just to the southeast of subpopulation C, each supported an estimated 400 sparrows each when first surveyed. By the 1992 survey, subpopulation C had declined to about 11 percent of its 1981 estimated size (Table 4). After at least 2 years with no sparrows, 48 sparrows were thought to reside in this area in 1996 and 1997, and 80 sparrows were estimated in 1998. Despite irregular seasonal inundation and frequent fires, this subpopulation has shown recent signs of recovery Cassey et al. 2007). Recent estimates of birds in Subpopulation C have been relatively stable, and may suggest a slight increase. Subpopulation D declined by about 76 percent from 1981 to 1993 (Table 4). Although no sparrows were found in 1995, the population was estimated at 80 sparrows in 1996 and 176 sparrows in 1999. High water levels since 2000 likely led to the decrease since 1999 (Slater et al. 2009) with 32 sparrows estimated in 2001. No sparrows were identified within subpopulation D from 2002 through 2004, but they were detected in 2005. The continual decline since its 1981 estimate of 400 sparrows has possibly left this subpopulation functionally extirpated with few sparrows detected during the 2006 to 2007 range-wide surveys (Lockwood et al., 2008) Subsequent surveys, including preliminary results through 2009, have documented sporadic sparrow use. Preliminary results for 2009 reveal breeding and nesting activity in several areas within the critical habitat for subpopulation D.

Overall, there have been many large population declines recorded among all of the subpopulations, and relatively few population increases. These population changes suggest that while declines can occur rapidly, it may take many years of favorable conditions to return to a stable population.

Recent information indicates that sparrow subpopulations C and D may support fewer CSSSs than previously estimated, and the demographics of these subpopulations may differ from the larger subpopulations (Lockwood et al. 2006). Because CSSSs typically experience low nest survival, low juvenile survival, and have a relatively short life span, we cannot expect sparrow recovery to be rapid (Lockwood et al., 2001). The demographic attributes of CSSSs preclude them from rapid recovery particularly when consistently faced with poor conditions (*i.e.*, high water levels and frequent fires) (Lockwood et al., 2008). This information affects assessment of the likelihood of the persistence of these subpopulations and the overall probability of persistence for the species. With smaller population sizes in these subpopulations than previously assessed, the relative significance of subpopulations B and E with respect to maintaining a viable overall sparrow population is increased. Similarly, evaluations of the potential contributions of the small subpopulations to maintaining the overall sparrow population and buffering it from potential catastrophic events such as widespread fire are reduced. Pimm et al. (2002) and Walters et al. (2000) suggested that three breeding subpopulations are necessary to the long-term survival of the CSSS. However, Slater et al. (2009) emphasize the need to recover all subpopulations, noting that with 90 to 97 percent of CSSS concentrated within two subpopulations (B and E), the species' vulnerability to stochastic events is particularly acute. Slater et al. (2008) observed that even though the overall sparrow population has remained stable since the massive decline it experienced in the 1990s, the population has shown minimal signs of recovery and little of the habitat restoration deemed necessary for their recovery.

Critical Habitat

Critical habitat for the CSSS was initially designated on August 11, 1977 (42 FR 42840). The critical habitat designation was revised November 6, 2007 (50 FR 62736) and included primary constituent elements, the physical and biological features that are essential for conservation of the species. Currently, critical habitat includes areas of land, water, and airspace in the Taylor Slough vicinity of Collier, Miami-Dade, and Monroe Counties. Much of this area is within the boundaries of ENP. The designated area encompasses about 84,865 ac (79,828 ha), and includes portions of subpopulations B through F (Figure 143). Approximately 58,000 ac of CSSS critical habitat in subpopulations B, C, and D are located within the C-111SC Project study area (Figures 13 and 14).

Eastern Indigo Snake

The eastern indigo snake was listed as a threatened species in January 1978 as a result of dramatic population declines caused by over-collecting for the domestic and international pet trade as well as mortalities caused by rattlesnake collectors who gassed gopher tortoise *(Gopherus polyphemus)* burrows to collect snakes. Since its listing, habitat loss and fragmentation by residential and commercial expansion have become much more significant threats to the eastern indigo snake (Service 1999).

Over most of its range, the eastern indigo snake frequents several habitat types, including pine flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats. Eastern indigo snakes need a mosaic of habitats to complete their annual cycle. Interspersion of tortoise-inhabited sandhills and wetlands improves habitat quality for this species (Service 2004c). In the milder climates of central and southern Florida, eastern indigo snakes exist in a more stable thermal environment, where availability of thermal refugia may not be as critical to the snake's survival. Throughout peninsular Florida, this species may be found in all terrestrial habitats which have not suffered high density urban development. They are especially common in the hydric hammocks throughout this region (Service 1999). In central and coastal Florida, eastern indigo snakes are mainly found within many of the State's high, sandy ridges. In extreme south Florida, these snakes are typically found in pine flatwoods, pine rocklands, tropical hardwood hammocks, and in most other undeveloped areas (Service 1999). Eastern indigo snakes are known to use levees which impound water in south Florida. Eastern indigo snakes also use some agricultural lands (such as citrus) and various types of wetlands (Service 1999).

The threatened eastern indigo snake may be present within and adjacent to the proposed project boundaries. Most of the potential C-111SC study area can be considered eastern indigo snake habitat except for open water not associated with tree islands, levees, or banks and disturbed areas not associated with vegetative cover. An adult eastern indigo snake's diet may include fish, frogs, toads, snakes, lizards, turtles, turtle eggs, juvenile gopher tortoises, small alligators, birds, and small mammals. Juvenile eastern indigo snakes eat mostly invertebrates (Service 1999). Indigo snakes range over large areas and into various habitats throughout the year with most activity occurring in the summer and fall. Because of its relatively large home range (185 ac for males and 47 ac for females), this snake is especially vulnerable to habitat loss, degradation, and fragmentation (Service 1999). The eastern indigo snake will use most of the habitat types available in its home range, but prefers open undeveloped areas. This species requires sheltered "retreats" from winter cold and desiccating conditions, such as gopher tortoise burrows.
No critical habitat has been designated for this species.

American Crocodile

The American crocodile is one of the two species of crocodilians endemic to the United States. It is a large, greenish-gray crocodilian with adults reaching lengths of approximately 12 ft in Florida. The current distribution of the American crocodile in the United States is limited to extreme southern Florida. The American crocodile is found primarily in mangrove swamps and along low-energy mangrove-lined bays, creeks, and inland swamps (Kushlan and Mazzotti 1989). During the non-nesting season crocodiles are found primarily in the fresh and brackish waters in inland swamps, creeks, and bays. During the breeding and nesting season (spring and summer) adults use the exposed shorelines of Florida Bay. Natural nesting habitat includes sites with sandy shorelines or raised marl creek banks adjacent to deep water. Crocodiles also nest on elevated man-made structures such as canals berms (Service 1999). Habitat loss and fragmentation due to urbanization and agricultural land uses are the biggest threats to this species. In Florida, changes in the distribution, timing, and quantity of water flows have affected this species, although the specifics of these effects are not clear.

The American crocodile is known to range throughout southern Biscayne Bay, Card Sound, Barnes Sound, and portions of Florida Bay. Crocodiles exist in the project area mostly in ponds, canals and shorelines at densities ranging from 0.0 to 0.29 crocodile per 0.6 mile (Cherkiss 1999). Canal banks similar to the levee associated with major canals in the project area are generally suitable for nest sites, and the berms associated with the old east-west agricultural secondary canals may also be suitable for nesting. However, nesting within the project area is not well documented. Known nest sites are located at the cooling canals of FPL's Turkey Point Power Plant, which supports the most successful nesting population in south Florida (Mazzotti et al. 2002). These cooling canals occupy the eastern section of the Model Lands, but lie outside the project area. Crocodiles also nest at Crocodile Lake National Wildlife Refuge, which is located in the southern end of Barnes Sound, and along creeks and beaches in north-east Florida Bay.

Recent studies indicate an increase in the number of nests occurring in the cooling canal area of the Turkey Point Power Plant since the early 1980s, while nest numbers at the Crocodile Lake National Wildlife Refuge have remained relatively stable (Mazzotti et al. 2002). Nesting success at the Turkey Point Power Plant may be responsible for an increase in the number of crocodile sightings occurring north of the plant, and may indicate an expansion of the animal's range. Although nest numbers have remained relatively stable at the Crocodile Lake National Wildlife Refuge, the population in this area may be increasing, based on an increase in the number of crocodile sightings throughout the Florida Keys and an increase in the number of road kills occurring along U.S. Highway 1 and Card Sound Road over the past several years (Klett 2003).

One of the primary C-111SC Project objectives is to restore a more natural salinity gradient to the coastal wetlands. Watershed flow through conveyance canals has created an unnaturally high salinity environment in these wetlands, which has caused a loss of graminoid marshes and a landward migration of mangrove wetlands (Ross et al. 2002; Sklar et al. 2002). Juvenile crocodiles require low salinities for growth and survival presumably because they have limited physiological capability to osmoregulate. The ideal salinity range for crocodiles is less than 20 parts per thousand (ppt) (Mazzotti et al. 2002). As salinity levels increase above 20 ppt, habitat suitability decreases. Redirecting freshwater from conveyance canals into the coastal wetlands may lower salinities there, which may increase suitable habitat for juvenile crocodiles.

The C-111SC Project area overlaps designated critical habitat for the American crocodile (44 FR 75076; December 18, 1979). The northern boundary of critical habitat for this species begins at the easternmost tip of Turkey Point and extends southeast and southwest across the southern part of the project area (Figure 14). Thus, the Model Lands, including the wedge area between U.S. Highway 1 and Card Sound Road, lie within critical habitat for this species.

Roseate Tern

The roseate tern is strictly a coastal species, usually observed foraging in nearshore surf. In the winter, the roseate tern is pelagic in its habits. Open sandy beaches isolated from human activity are optimal nesting habitat for the roseate tern. A variety of substrates, including pea gravel, open sand, overhanging rocks, and salt marshes are used. In extreme southern Florida, roseate terns typically nest on isolated islands, rubble islets, dredge-spoil, and rooftops and are mostly observed breeding between Marathon and the Dry Tortugas (Service 1999). The C-111SC Project as currently proposed is not anticipated to adversely affect this species due to the location and characteristics of habitat utilized.

Schaus Swallowtail Butterfly

The present distribution of the Schaus swallowtail butterfly extends from southern Miami-Dade County through the Keys in Biscayne Bay and north to southern Key Largo in the Upper Keys, to Lower Matecumbe Key in the Middle Keys. The Schaus swallowtail butterfly occurs exclusively in subtropical dry forests (hardwood hammocks) including areas that were formerly cleared and farmed, but have since regrown (Service 1999). The C-111SC Project as currently proposed is not anticipated to adversely affect this species due to the location and characteristics of habitat utilized.

Crenulate Lead-plant

The crenulate lead-plant is a perennial, deciduous shrub that inhabits marl prairies and wet pine rocklands in a small area of Miami-Dade County. This pine rockland community is maintained by periodic fires. The crenulate lead-plant is known from a 20 square-mile area from Coral Gables to Kendall, Miami-Dade County (Service 1999). The C-111SC Project as currently proposed is not anticipated to adversely affect this species based on the location of known populations.

Garber's Spurge

Garber's spurge is a short-lived, perennial herb belonging to the Euphorbiaceae or spurge family. This species is known from pine rocklands, coastal flats, coastal grasslands, and beach ridges in Miami-Dade and Monroe Counties, Florida. It requires open sunny areas and needs periodic fires to maintain habitat suitability. It is found throughout its historic range and is abundant in some areas, but the populations are relatively disjunct. It is abundant on Cape Sable and is probably found throughout the Keys in small numbers. Habitat loss and exotic plant invasion threaten its recovery (Service 1999). The C-111SC Project as currently proposed is not anticipated to adversely affect this species based on the location of known populations.

Tiny Polygala

Tiny polygala is in the family Polygalaceae, commonly referred to as the milkworts. It was once thought to be endemic to Miami-Dade and Broward Counties, but recent surveys have extended its range to southern St. Lucie County. It is now known to occur on the Atlantic Coastal Ridge of southeast Florida, from the Perrine area of Miami-Dade County north to southeast St. Lucie County. All 11 known populations are found within 9.7 km of the Atlantic Coast. The tiny polygala or Small's milkwort is a short-lived herb. The only known populations occur in sand pockets of pine rocklands, open sand pine scrub, slash pine, high pine, and well-drained coastal spoil (Service 1999). The C-111SC Project as currently proposed is not anticipated to adversely affect this species based on the location of known populations and its habitat preference.

2. State-listed Species

State-listed species of special concern (SSC) identified by the FWC as State-listed species that may be affected by the project include the American alligator, gopher tortoise, burrowing owl (*Athene cunicularia*), and colonial wading birds, such as the roseate spoonbill (*Ajaia ajaja*), little blue heron (*Egretta caerulea*), snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), and white ibis (*Eudocimus albus*). Colonial wading birds in ENP and WCA 3 use the woody vegetative structure of tree islands for nesting and roosting. High water conditions occurring during nesting season can result in nest failure if the birds are unable to access sufficient prey for their young. Other SSC wading birds include the Florida sandhill crane (*Grus canadensis pratensis)* and the limpkin *(Aramus guarauna)*. Burrowing owls typically occur in open, well-drained treeless areas where herbaceous ground cover is short. Although their natural habitats are primarily dry prairies and the dry margins of depressional marshes, they are frequently associated with unnatural elevated features such as canal banks and road berms. Florida burrowing owls have been observed nesting from early October to early July, but most nesting occurs during the relatively dry period from February through late May. Use of burrows decreases during the summer because frequent heavy rains cause many of them to flood. Adults show a high degree of fidelity to territories (Millsap 1996). Owls and nests are protected by FWC rules (Chapter 39, FAC) and Federal rules promulgated under the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 701 *et seq*.).

3. Other Fish and Wildlife Resources Including NOAA Fisheries Trust Species

Species listed under the purview of the National Marine Fisheries Service (NOAA Fisheries) as endangered and that may be encountered in or adjacent to the project area include: green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and smalltooth sawfish (*Pristis pectinata*), and the threatened loggerhead sea turtle (*Caretta caretta*). We recommend you contact NOAA Fisheries regarding potential impacts to these species.

The above-listed species have a presence in south Florida waters and are known to utilize bays and estuarine habitats for feeding and resting. Sea turtles forage in the near shore waters, bays and sounds of Florida and come ashore seasonally at night to nest on the beaches above the high tide line. Alterations in the timing and quantity of freshwater flowing through the estuary has had an impact on biodiversity by altering food availability, increasing predation pressure, decreasing reproductive success, and most likely has caused stress to these species.

The green sea turtle may be present in the project area feeding on sea grasses. The leatherback may be present depending on the presence of jellyfish, and the loggerhead may be found foraging in the area for crustaceans or mollusks. The hawksbill may also be found in the area as it feeds predominantly around coral reefs on sponges, which can be found on hard grounds (limestone bottom colonized by sponges, small corals, and algae). The Kemp's Ridley sea turtle is least likely to be found here due to its rare occurrence in Florida's coastal waters.

The Service's jurisdiction over listed sea turtles is limited to beach and shoreline habitat above Mean High Water. Because suitable nesting habitat does not exist for sea turtles in the project area, impacts to these animals are not a concern to the Service with regards to this project.

Smalltooth Sawfish

Smalltooth sawfish are tropical marine and estuarine fish that have the northwestern terminus of their Atlantic range in the waters of the eastern United States. In the United States, smalltooth sawfish are generally a shallow water fish of inshore bars, mangrove edges, and seagrass beds, but are occasionally found in deeper coastal waters. Prior to 1960, smalltooth sawfish occurred commonly in shallow waters of the Gulf of Mexico and eastern seaboard up to North Carolina, and more rarely as far north as New York. Subsequently their distribution has contracted to peninsular Florida and, within this area, can only be found with any regularity off the extreme southern portion of the State. Juvenile smalltooth sawfish may be especially vulnerable to coastal habitat degradation due to their affinity for shallow, estuarine systems.

Other fish and wildlife species that are adapted to sawgrass, marsh, disturbed marsh, exotic infested and urbanized land occur throughout the study area. The adjacent canals and drainage systems are likely to support amphibians, reptiles, fish, and wading birds, although no comprehensive inventory of existing use of the project site or study area by wildlife has been conducted. Migratory and resident bird species have been observed flying around the C-111SC study area and are likely to utilize the varied habitat available within the study area. Small to medium sized mammals may also occur within the study area. Table 3 lists fish and wildlife species not protected under Act likely to occur in the project study area.

Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act. The South Florida ecosystem is located along one of the primary migratory routes for bird species that breed in temperate North American and winter in the tropics of the Caribbean and South America. Many species of neotropical migrants have been recorded in the South Florida ecosystem. A 1995 amendment to the Migratory Bird Treat Act included a list of migratory nongame birds of management concern in the United States to stimulate a coordinated effort by Federal, State, and private agencies to develop and implement comprehensive and integrated approaches for management of these selected species. Forty-three of these species are found in the South Florida ecosystem. Other migratory species such as the tanagers (*Pirange* spp.), chimney swifts (*Chaeturaa pelagica*), tree swallows (*Iridoprocne bicolor*), nighthawks (*Chordeiles minor*), royal terns (*Sterna maxima*), and blue-winged teal (*Anas discors*) also have major migratory pathways through and to (as winter residents) south Florida. More than 129 bird species migrate to the South Florida ecosystem to overwinter. Another 132 bird species breed in south Florida. Because the South Florida ecosystem is located near Cuba and the West Indies, it draws tropical species that rarely appear elsewhere in North America. Examples include the smooth-billed ani (*Crotophaga ani*), mangrove cuckoo (*Coccyzus minor*), Antillean nighthawk (*Chordeiles gundlachii*), white-crowned pigeon (*Columba leucocphala*), gray kingbird (*Tyrannus dominicensis*), short-tailed hawk (*Buteo brachyurus*), Everglade snail kite, and black-whiskered vireo (*Vireo altiloquus*). The South Florida ecosystem has an endemic race of the yellow warbler (*Dendroica petechia*) and contains the majority of the nesting locations for the reddish egret (*Egretta rufescens*), roseate spoonbill, swallow-tailed kite (*Elanoides forficatus*), and short-tailed hawk (*Buteo brachyurus*) in the United States.

Shorebirds that migrate along the Atlantic coast of Florida on their way to and from South America use the beach dune community for food and shelter while songbirds use the coastal strand, maritime hammock, and mangrove communities. The FWC identified 26 species of shorebirds and 27 species of songbirds that use coastal barriers during migration as rare or declining species (Enge et al. 1997). Fifteen of these, 12 shorebirds and 3 songbirds, have also been identified as birds of conservation concern (Service 2002) and the Service is developing a strategy to protect breeding, migration, and wintering habitat for these species. As a public trust resource, migratory birds must be taken into consideration during project planning and design. For more information please see the Service's website at http://migratorybirds.fws.gov/.

Fifteen species of herons, storks, and ibises nest in south Florida and are considered ecological indicators because of their wide foraging ranges, relatively narrow food requirements, and relatively specific habitat requirements. Their breeding success reflects the health of the wetland and coastal habitats of south Florida. Migratory songbirds, raptors, and wading birds utilize a variety of habitats within the C-111SC Project area and represent noted trust resources for the C-111SC Project area.

The C-111SC project study area encompasses a wide variety of habitats including wooded, marsh, estuarine, and shoreline habitats that are extremely important as habitat for migratory birds. Maintaining these sites as high-quality habitat for migratory birds is important given that the tip of the south Florida peninsula is the last feeding stop on the Eastern Flyway in North America before the birds migrate south across the Caribbean Sea or the Gulf of Mexico in the fall, and the first feeding stop on the continent as the birds migrate north in the spring. Also, the fact that much of the migratory bird habitat in south Florida has been lost to urban or agricultural development over the last century underlines the importance of preserving and maintaining viable migratory bird habitat in this area.

There are several areas within the C-111SC Project study area of note. The Frog Pond Wildlife Management Area (WMA) managed by the FWC and the District consists of nearly 500 ac that was part of a 5,385-acre former agricultural area purchased by the State in 1994 as part of Everglades restoration efforts. The Frog Pond WMA is south of State Road (SR) 9336, 8 miles west of Homestead, and north of the Southern Glades Wildlife Environmental Area. Special Opportunity Dove Hunts are permitted in this area each year. The Frog Pond dove field is located just outside the entrance of ENP. Another managed site, Lucky Hammock, located beside Aerojet Road, is an excellent birding spot. During migration, this area is a "jump off" site for the Atlantic Flyway, giving birders viewing access to migrating raptors, such as the peregrine falcon, and neotropical migrants, including painted buntings and numerous warblers. This area is part of the Great Florida Birding Trail. One hundred eighty-eight bird species have been observed since November 2001 at this site.

III. FISH AND WILDLIFE RESOURCE CONCERNS

A. Climate Change

According to the Intergovernmental Panel on Climate Change Report (IPCC 2007), warming of the earth's climate is "unequivocal," as is now evident from observations of increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising sea level. The IPCC Report (2007) describes changes in natural ecosystems with potential wide-spread effects on many organisms, including marine mammals and migratory birds. The potential for rapid climate change poses a significant challenge for fish and wildlife conservation. Species' abundance and distribution are dynamic, relative to a variety of factors, including climate. As climate changes, the abundance and distribution of fish and wildlife will also change. Highly specialized or endemic species are likely to be most susceptible to the stresses of changing climate. Based on these findings and other similar studies, the Department of the Interior requires agencies under its direction to consider potential climate change effects as part of their long-range planning activities (Service 2008a).

Climate change at the global level drives changes in weather at the regional level, although weather is also strongly affected by season and by local effects (*e.g.*, elevation, topography, latitude, proximity to the ocean. Temperatures are predicted to rise from 2°C to 5°C for North America by the end of this century (IPCC 2007). Other processes to be affected by this projected warming include rainfall (amount, seasonal timing, and distribution), storms (frequency and intensity), and sea level rise. However, the exact magnitude, direction, and distribution of these changes at the regional level are not well understood or easy to predict. Seasonal change and local geography make prediction of the effects of climate change at any location variable. Current predictive models offer a wide range of predicted changes.

The 2007 IPCC report found a 90 percent probability of 7 to 23 in of sea level rise by 2100. Wanless et al. (1994) found that, over the past 2,500 years, south Florida has experienced an average rate of sea level rise of about 1.5 in per century. Wanless (2008) also observed that south Florida has experienced about a 9-in rise in sea level since 1932. This is about eight times the average rate over the past 2,500 years. Much of this accelerated rise is the result of warming and expansion of water in the western North Atlantic Ocean.

Prior to the 2007 IPCC Report, Titus and Narayanan (1995) modeled the probability of sea level rise based on global warming. They estimated that the increase in global temperatures could likely raise sea level 6 inches by 2050 and 13 in by 2100. While these estimates are lower than the estimates described in the IPCC Report (2007), Titus and Narayanan's (1995) modeling efforts developed probability-based projections that can be added to local tide-gauge trends to estimate future sea level at specific locations.

It should be noted that Titus and Narayanan's (1995) worst-case scenario was premised on a 1 percent chance that global warming would raise sea level that high. However, most climate change researchers agree with the findings in the IPCC Report (2007) which estimates a 90 percent probability of 7 to 23 in of sea level rise by 2100. Scientific evidence that has emerged since the publication of the IPCC Report (2007) indicates an increase in the speed and scale of the changes affecting the global climate. Important aspects of climate change seem to have been underestimated and the resulting impacts are being felt sooner. For example, early signs of change suggest that the less than 1°C of global warming the world has experienced to date may have already triggered the first tipping point of the Earth's climate system – the disappearance of summer Arctic sea ice. This process could open the gates to rapid and abrupt climate change, rather than the gradual changes that have been currently forecasted.

Climatic changes in south Florida could amplify current land management challenges involving habitat fragmentation, urbanization, invasive species, disease, parasites, and water management (Pearlstine 2008). Global warming will be a particular challenge for endangered, threatened, and other "at risk" species. It is difficult to estimate, with any degree of precision, which species will be affected by climate change or exactly how they will be affected. The Service will use Strategic Habitat Conservation planning, an adaptive science-driven process that begins with explicit trust resource population objectives, as the framework for adjusting our management strategies in response to climate change (Service 2006d).

B. Altered Hydrology and Operations

Settlers to Dade County began modifying the natural hydrologic regime in the early 1920s to make the area more suitable for agriculture and urban development. The combined efforts of the State and Federal governments and private interests resulted in the construction of a network of water control structures, canals, and levees with the goal to eliminate flooding that frequently occurred in most of the area. Associated with this larger network, an expansive infrastructure of roads, berms, culverts, ditches, rock pits, building pads, etc. has further contributed to modification of the natural hydrology. An expansive engineering system known as the Central and Southern Florida Project (C&SF Project) by 1967 had mostly taken control of the entire hydrologic system of Dade County. This project has been extremely successful in meeting its dual missions of flood control and water supply. There has been some effort directed to modify project water management operations since the 1980s to provide some environmental benefit mostly in the form of post-design modifications. The overriding dilemma however is how to provide flood control, water supply, and environmental benefits concurrently. Prior management emphasized reduction of the depth and extent of peak water levels during the wet season and maintenance of higher water levels during the dry season for irrigation benefit, providing additional deliveries to ENP, and reducing the risk of saltwater contamination to municipal well fields. This has resulted in an altered hydrologic system unlike the natural rhythms of wet season flooding and slow recession drying during the dry season. From an environmental perspective, these flood control and water supply manipulations are undesirable in that they rapidly drain away surface water and ground water after rainfall events, and impede seasonal patterns of wetting and drying. By managing the canals in the project study area at fixed levels and allowing only a minimum, constant amount of water through the network, the wetlands have functionally been disconnected from rainfall, the most important natural hydrologic driver. The consequence of these actions has been habitat loss and reduction in wildlife populations.

Figure 2 illustrates the Southern Glades adjacent to Taylor Slough and its relationship to the project study area. Restoration of the Southern Glades is integral to the long range recovery of Florida Bay. Located within the Southern Glades, the C-111 canal bisects the area. The canal was built originally for ferrying rocket engines from a testing facility (Aerojet), located near the entrance to ENP. The C-111 canal was connected to the L-31N canal in the late 1960s and became an integral part of flood control efforts for Miami-Dade County. Ecologically however, the C-111 canal has been detrimental in that it pulls water from Taylor Slough, reducing flows to central Florida Bay via Little Madeira and Joe Bays, and routing it south and east to where it now enters Florida Bay at Long Sound and Little Blackwater Sound. The net result is that central Florida Bay has been deprived of freshwater and subject to high salinity levels. Concurrently, the C-111 canal periodically discharges from extreme high flow events at a point source discharge to Manatee Bay and Barnes Sound via the S-197 structure and can cause rapid salinity fluctuations damaging to estuarine and marine communities. These fluctuations can severely impact or kill attached or rooted benthic organisms and plants as well as impact fish communities (Brook 1982; Montague and Ley 1993; Irlandi et al. 1997; Lorenz 1997; Serafy et al. 1997)

Another aspect of the altered hydrology in the project study area due to the construction of the L-31N/C-111 canal complex is that rerouting flow through the eastern portion of the flowway through C-111 has been accomplished at the expense of flows through Taylor Slough. Currently the majority of water exiting the C-111 canal through gaps in the southern levee of the canal does so near U.S. Highway 1 because the eastern most gap is at a lower elevation than those to the northwest.

Additional ecological effects of reduced freshwater flow to Florida Bay, particularly during the dry season, and a lowering of the water table include: (1) loss of recreational and commercially important fishery species, such as red drum, due to disruption of the historic salinity regime; (2) loss of oyster bars, and their associated faunal communities, due to salinity changes; (3) displacement of oligohaline (salinity between 0 and 5 ppt) graminoid marshes by mangrove wetlands and forested and shrub wetlands; (4) expansion and landward intrusion of the "white zone" (the area of stunted mangroves and sparse sawgrass and spike rush that is caused by a combination of increased salinity and decreased nutrients) in the Model Lands Basin (Ross et al. 2002); (5) intrusion of saltwater into coastal well fields; (6) decrease in freshwater fish biomass in those wetland areas that have experienced a transition from zero or low salinity conditions to higher salinity conditions; (7) reduced wading bird habitat in the coastal ecotone as a result of the reduction in prey fish productivity and availability; and (8) reduction in water quality as water from the watershed empties directly into the bay without the benefit of treatment provided by the historic broad sheetflow through the coastal wetlands.

C. Water quality

Ludlum Slough (also known as Loveland Slough), is located within the C-111SC Project study area and lies between the C-111 canal just northeast of the S-177 water control structure and Ingraham Highway (S.R. 9336) at the S-178 structure. The slough is approximately three miles in length and is a fairly narrow and shallow watercourse fed by both groundwater and surface water. The source of the slough is just east of the C-111 canal, but no physical connection exists between the canal and slough. From its origin, the slough flows downstream to the S-178 structure which controls the flow out of Ludlum Slough into the C-111E canal. The water levels in the C-111E canal are controlled by the S-18C structure farther downstream on the C-111 canal. Total phosphorus (TP) samples are collected on the headwater side of the S-178 structure. The mean TP concentration for the period of record (2000 – 2009) is 42 parts per billion (ppb), the 90th centile concentration is 92 ppb, and the maximum concentration is 286 ppb. The TP concentrations recorded at the S-178 structure are higher than the TP concentrations recorded between 2000 and 2009, in the C-111 canal at the S-777 structure. The mean TP concentration at S-177 is 7 ppb, the 90th centile concentration is 11 ppb, and the maximum concentration is 126 ppb (District 2006).

The TP concentrations at S-18C are similar to those at S-177. This is because historically, only approximately 4 percent of flow volume that reaches the S-18C is attributable to the C-111E canal resulting in a significant dilution effect on dissolved pollutants. Pumping of water from the C-111E canal could potentially distribute phosphate laden water into downstream marshes. Higher levels of TP concentrations documented by sampling in C-111E canal water (exceedance of 10 ppb) have the potential to stimulate cattail colonization of formerly oligotrophic marsh communities. In such cases the role of cattail can change from its natural function in the Everglades as an early colonizer of disturbed areas that is eventually replaced by other vegetation types such as sawgrass, to a long-term dominant in formerly oligotrophic marshes that have become eutrophic and form permanent stands (Davis 1994). If pumping of C-111E canal water

and the resultant water mix with C-111 canal water results in discharge into downstream marshes with higher phosphorus levels, disruption of the natural vegetation community could occur.
A multiyear study in the C-111 canal system (including C-111E and the Ludlum Slough area), and associated sites in Florida Bay was conducted to determine the potential pesticide risk that exists in south Florida (Scott et al. 2002). The study examined extensive pesticide concentration data in surface water, tissues, and semipermeable membrane sampling devices, and determined that canal contamination appears to be attributable to widespread agricultural production from the watershed that drains into the C-111 canal. The results of this study indicate that runoff from agricultural processes led to quantifiable pesticide residues in both canal and bay surface water, which have historically exceeded current water quality criteria. The major pesticide of concern was endosulfan, which was detected at 100 percent of the sites sampled. Endosulfan exposure did not cause any acute effects in fish and crustaceans deployed in field bioassays. Chronic effects were observed in copepods, clams, and oysters but these effects could not be attributed to endosulfan exposure. Samples collected from the C-111E canal at the S-178 structure contained the highest concentrations and frequency of occurrence based on the study. The study concluded that the decision to alter the C-111 canal flow and allow increased freshwater flow into the adjacent ENP may result in discharges of pesticides into the Everglades, and recommended that continued monitoring in this area was needed during the change in flow regime associated with the project (Scott et al. 2002). The Service looks forward to information from the project implementation which will provide greater inference about the relationships of potential heavy metals and pesticides in the project study area.

D. Contaminants

The Frog Pond site is intended to be a 'leaky reservoir', designed to reduce the migration of groundwater away from the Everglades and from Taylor Slough. This will be accomplished by creating a groundwater mound between the Everglades and the C-111 canal by placing water into the reservoir when it is available. Analysis of soils at the site indicated that a number of agrochemicals were present at concentrations that exceeded Florida Department of Environmental Sediment Quality Assessment Guidelines, and corrective action was potentially needed prior to construction of the project. The District conducted a pilot study (URS 2008) to test the effectiveness of complete soil removal as a possible corrective action. Results of the pilot study indicated that where soils were scraped from the limestone cap rock, the mass of copper and zinc in the study area was greatly reduced, but concentrations in the remaining soils were still greater than risk-based benchmarks, particularly for copper. This study was designed to address potential risk issues at the site should soil scraping be chosen as the preferred corrective action at the site. The study addressed questions about potential changes in chemicals of potential environmental concern (COPEC) concentrations in surface water and sediment with time, given repeated inundation cycles, the toxicity of the sediments to aquatic invertebrates, and the potential for COPECs to bioaccumulate in the system to potentially problematic levels following soil scraping.

The screening level ecological risk assessment (SLERA) presented in the Phase I/II Environmental Site Assessment (ESA) requested by the Service indicated the potential for risk to the Everglade snail kite from exposure to copper, zinc, and DDE and to the osprey receptor from exposure to 4,4'- DDE. In order to address these issues on a more site-specific basis, three bulk soil samples were collected from an area believed to be representative of upper-bound agro-chemical contamination in the Frog Pond soils: one from an area representing upper-bound contaminant concentrations and two from the area scraped during the pilot study. The area from the upper-bound contaminant concentrations is now outside of the new project footprint. Analysis of the sample confirmed the presence of agro-chemicals in the sample at concentrations equal to or higher than the 95 percent upper confidence limit (UCL) concentrations from the Frog Pond project area calculated by URS Incorporated, the District's contractor for the Frog Pond site. Their report indicates that the bioaccumulation tests conducted on the sample are adequately conservative for providing a reasonable worst-case estimate of risks if the soils within the impoundment are allowed to remain in place.

While final comments have not been issued, the Service responded with concerns and recommendations regarding the general conclusions of the Ecological Risk Assessment (ERA) for Frog Pond soils. In response, the District conducted an additional soil investigation for the Frog Pond site. This analysis recommended soil scraping of the project footprint in conjunction with utilization of those soils for berm construction capped with clean soils. The Service concurred with this recommendation, provided:

1. Post-scraping confirmatory sampling be conducted on a representative percentage of the project site.
2. Confirmatory sampling should include a measure of the relative percent of soil remaining and the concentration of copper within these soils.
3. These data should be used to calculate an estimated area-weighted average for the entire Frog Pond Detention Area (FPDA).
4. Once these confirmatory samples are collected, determination about the need for monitoring or further remediation can be made.
5. If Frog Pond soils are to be reused in the construction of berms, they pass all leachability testing criteria.

The full context of the Service response letter dated May 27, 2009, to the Frog Pond ERA and the Additional Soil Investigation is provided in Appendix F.

E. Migratory Birds

One of the primary objectives of the C-111SC Project is to optimize the delivery and timing of flow to Taylor Slough, in part through the construction of a large detention basin in the Frog Pond Detention Basin (FPDB) area. Most of the undeveloped freshwater C-111 basin lands are comprised of natural areas (wetlands) and farms. Since it is environmentally undesirable to convert existing wetlands into storage reservoirs, the planned FPDB will be sited on lands that have been used for agriculture. The inundation of agricultural lands contained within the footprint of the FPDB may result in the mobilization of toxic agricultural chemicals into the food chain. The death of migratory birds in central Florida in the late 1990's (Guillette et al. 1994; Heinz et al. 1991; Toft and Guillette 2005; Williams 1999) is an illustrative example of one potential consequence of inundating former agricultural lands. To prevent such events, the Corps and the District are working with the Service to screen potential project land prior to construction and operation of the FPDB. Towards this end, the Corps, District, and Service have developed an environmental screening protocol that is being implemented during the project planning phase for those lands within the FPDB footprint. The intent of the protocol is to screen potential project lands to identify those areas that may have disperse residual contamination at excessive levels and identify remedial measures if possible. Areas identified as having excessive disperse contamination will either be avoided or be remediated by the project sponsor. In addition aspects of construction and operation of the FPDB need to be examined such as the length of time and special extent the FPDB will be inundated, the potential for development for an aquatic ecosystem, and what risks could be inherent for bioaccumulation of toxic agricultural chemicals into the food chain.

F. Hydrologic Modeling Issues

The rationale for utilization of the Modbranch model to simulate hydrology in the project study area was to simulate scenarios (*i.e.*, natural system, present, and future with, and future without alternatives, etc.) for three representative years, average (1978), dry (1989), and wet (1995). These years were determined to be representative based on an examination of the historical hydrologic record of available data. The use of three representative years had the advantage of reducing the amount of data analyses and processing time and expense for purposes of expediting planning for the project. However, use of only 3 representative years (average, wet, dry), decreases the available detail and statistical analyses that could have been conducted. Climatic and associated hydrologic variation within the annual cycles are therefore suppressed and cannot be factored into our analyses.

Examination of the base ground surface elevation coded into the Modbranch model revealed discrepancies between ground surface elevations for some cells within the model domain and known elevation locations within the project study area that could not be corrected due to time and funding constraints. In some cases these comparative elevations may have differed by up to one foot. For purposes of this analysis it was necessary to examine the relative difference between metrics of scenarios (for example, the change in hydroperiod, between with and without project model output) rather than an analysis of actual on the ground conditions. Unfortunately these discrepancies could not be corrected due to time and funding constraints and this has complicated the Service's ability to analyze species-specific effects.

G. Implementation of Ecological Monitoring and Adaptive Management Plans

The Service has contributed to the development of an Ecological and Water Quality Monitoring Plan for the C-111SC Project. The intent of the plan is to determine if the anticipated hydrologic, vegetative, wildlife, and estuarine benefits of the project are being achieved and to support the adaptive management process over the life of the project. This plan will provide for baseline, construction, and post-restoration monitoring of water quality, ground and surface waters, salinity, wetland vegetation and periphyton, submerged aquatic vegetation, aquatic fauna, and CSSS. This plan has been coordinated with the Restoration Coordination and Verification (RECOVER) Monitoring and Assessment Plan. The Service recommends development of an adaptive management plan for the project. Such a plan is needed to determine which steps should be taken in the event that expected restoration results are not realized.

The Service is concerned that the recommended ecological monitoring plan and recommended adaptive management plan will not be fully implemented due to lack of dedicated funding at the project level. Also, RECOVER has determined that the RECOVER Monitoring and Assessment Plan will not incorporate all monitoring parameters recommended for the project by the PDT. Given the lack of modeling and the high level of uncertainty in the realization of restoration goals and objectives for this project, the implementation of sound monitoring and adaptive management plans are vital to project success.

Additional justification for implementing a robust monitoring and adaptive management plan can be found in the Restudy Chief's Report (Corps 1999). Section nineteen of the report states: "The reporting officers recommend the authorization of an extensive Adaptive Assessment Program, which includes a system-wide monitoring program which will be conducted to support the ecosystem restoration objectives of the Comprehensive Plan. The monitoring program is a necessary component of the Comprehensive Plan to assure that ecosystem benefits are achieved in ENP, Biscayne Bay, Big Cypress National Preserve, the Loxahatchee National Wildlife Refuge, as well as other natural areas."

H. Integrating the Project with Comprehensive Restoration Efforts

1. Everglades System Wide Effort

Although there are numerous environmental restoration efforts in the vicinity of the proposed C-111SC project, these efforts are not expected to have any dramatic effects on the planning and design of the proposed project. The proposed C-111SC project is situated at the lowermost part of the Everglades watershed, where the wetland system ceases overland flow and empties into Florida Bay and its associated estuarine environments. The C-111SC Project as configured currently only receives and redistributes water from other CERP projects, none of which rely upon it for operations.

Listed within this section are brief descriptions of other key projects related to the C-111SC Project. Also included are short statements regarding any possible effects related to the C-111SC Western Project and if available the timing for implementation of these related projects.

C-111 Project

The C-111 General Re-evaluation Report (GRR) with an integrated Environmental Impact Statement (EIS) was completed and approved in 1994. The modifications planned in the GRR for the lower C-111 formed the basis for the C-111SC Project that would be implemented in

CERP. The GRR recommended modifications in the Frog Pond and Rocky Glades area that would benefit the Taylor Slough portion of ENP. These project modifications are designed to maintain existing flood protection and other C&SF Project purposes in developed areas east of C-111SC Project area while reducing seepage losses out of the lower eastern portion of ENP by creating a hydraulic ridge in a series of impoundments just west of the main C-111 canal.

The features are designed to prompt a sheetflow pattern of water distribution throughout Taylor Slough and southern Everglades and to create a hydrologic ridge that would reduce seepage losses from ENP. The new water control facilities and modifications to the existing C&SF Project would continue to be implemented as part of the on-going C-111SC Project. Flows would be diverted to Taylor Slough by the following components:

- Taylor Slough Bridge Replacement (completed in October 2000)
- Pump stations S-332A and S-332D (construction of S-332D completed in 1997)
- Construction of S-332B (completed in 2001)
- Construction of S-332C (completed in 2002)
- Construction of additional features of C-111 (ongoing)
- L-31W and S-332D Tieback Levees, Construction of two new north-south levees roughly parallel to existing L31N beginning at L31W near S175 and extending northward in the Rocky Glades area to the S-332A pump station.

In recognition of higher land costs and the importance of delivering to ENP water of sufficient quality as well as quantity, Congress authorized changes to the C-111 Project costshare and amended the project scope to include water quality features. These changes, authorized by the WRDA of 1996, would be implemented through a supplement to the C-111 GRR that is currently being prepared by Corps. The status of the C-111 project would affect the C-111SC in a number of ways. The design and timing of the spreader canal project assumed that the upstream components to manage seepage and divert flows to Taylor Slough would be constructed and operational. The resulting reduction in the volume of water flowing to the lower C-111 canal is a "without project condition" in the development of the C-111SC Project.

Based upon this assumption, a water quality treatment component is proposed to address any degradation of water quality that might result when seepage from the ENP no longer mixes with stormwater runoff from the developed areas of the C-111 canal project area. The reduced volume also decreases dependence on the lower C-111 canal to manage stormwater and to provide flood protection. The reduction in stormwater flow to the lower C-111 canal would make it feasible to backfill canals and remove structures without causing an impact to existing levels of flood projection. Since the CERP project is dependent upon the construction and operation of upstream features, any delays or modifications to the C-111 project must be addressed in the planning, design and implementation of the C-111SC Project.

Modified Water Deliveries to Everglades National Park Project

The authorized improvements are structural modifications and additions to the existing C&SF Project required to enable water deliveries for the restoration of more natural hydrologic conditions in ENP. Together, these improvements would enable the re-establishment of the historic Shark River Slough flow-way from Water Conservation Area (WCA) 3A through WCA 3B to ENP.

The General Design Memorandum (GDM) for the Modified Water Deliveries (MWD) project was approved in May 1993. The Project Cooperation Agreement (PCA) was executed in September 1994 and construction was initiated in 1995. Construction of new spillway structures S-355A and B and the raising of the Tigertail Indian Camp have been completed. Land acquisition is near completion for the 1992 flood mitigation levee/canal right-of-way around the 8.5 Square Mile Area (8.5 SMA).

Although the MWD project will influence the C-111SC Project, the only direct effects that will occur are possible increases in the amount of water available to the proposed C-111SC Western Project area. Additionally, water available to the C-111SC Project may be improved in quality. All features of the proposed C-111SC Project would be constructed regardless of the MWD project implementation schedule.

Comprehensive Everglades Restoration Plan Component–Biscayne Bay Coastal Wetlands Project

The purpose of the Biscayne Bay Coastal Wetlands (BBCW) CERP project is to rehydrate wetlands, reduce point source discharge, improve water quality and provide more natural timing and quantity of water to Biscayne Bay. The proposed project would replace lost overland flow and partially compensate for the reduction in groundwater seepage by redistributing, through a spreader system, available surface water entering the area from regional canals.

The BBCW project would not affect any of the project area that is proposed for both C-111SC Western PIR and the Eastern PIR. Additionally, it has been determined that the BBCW project and C-111SC Project will not compete for water to accomplish restoration purposes. The water that will be utilized for restoration in the BBCW project is completely derived from a different drainage basin than the water that will be utilized for the C-111SC Western project.

2. U.S. Highway 1 Improvement Project

The Florida Department of Transportation (FDOT) is currently constructing improvements to a 20.4-mile section of U.S. Highway 1 from Key Largo to Florida City that bisects the C-111SC Project study area. The purpose of the project is to improve public safety and facilitate evacuation of the Keys prior to a hurricane. The improvements include reconstruction of the existing two-lane roadway with the addition of a median and shoulders. The project also includes replacement of the C-111 Bridge, the Jewfish Creek Bridge, and removal of the Lake

Surprise Causeway. The project is also being constructed to improve hydrologic flow through the project corridor and allow wildlife movement across the corridor. A total of 25 pipe culverts and 4 bridges or wildlife underpasses will be installed north of the C-111 canal, and 16 box culverts and 4 bridges will be installed or replaced south of the C-111 canal (Service 2004d). These pipe culverts will have water control structures in place to allow water managers to equalize water levels on either side of the U.S. Highway 1 corridor and are an important component of the C-111SC Project. With the placement of water control structures, the FDOT is allowing the means for water equalization; however, the implementation and management of these structures has yet to be defined. The C-111SC Project and other CERP projects are planning to implement procedures that would benefit the hydrologic regime surrounding the U.S. Highway 1 Improvement Project corridor that could include a large-scale spreader canal that would redistribute water within the C-111 basin between U.S. Highway 1 and Card Sound Road. The regional benefit of ecosystem restoration under CERP is supported by the State and Federal agencies.

3. Model Lands Restoration

The Model Lands include approximately 46,000 ac of fresh and saltwater wetlands (Figure 2). The wetland communities located within the Model Lands and the C-111 Basin (also called the Coastal Everglades or Southeastern Everglades) are one of the remaining areas of short hydroperiod wetlands east of ENP. The restoration of natural flow patterns to both Florida and Biscayne Bays is essential to restoring the high intrinsic value of these wetland communities.

Given the large volumes of water required to maintain adequate hydroperiods throughout the Model Lands, full restoration of the area is unlikely under the BBCW Project. The BBCW Project has targeted several historical flow ways that extend into the northern Model Lands, directing minimal flows to areas which are most likely to realize restoration benefits. The BBCW PDT recommended incorporating a 0.5 ft increase in S-20 stage triggers to (a) increase hydroperiods in the southern Model Lands and (b) promote overland flow to Card Sound through 40 culverts that FPL is installing in the L-31E levee between S-20 and Card Sound Road. The Service supports this recommendation, and it is consistent with restoration planned by the adjacent C-111SC Project.

4. Florida Power and Light and RMC South Florida Mitigation

Florida Power and Light Company South Dade Mitigation Bank

The FPL's South Dade Mitigation Bank is 13,367 ac of wetland interspersed within the Model Lands project area. It is located south of Florida City and east of U.S. Highway 1 (Figure 15). The site has been divided into four major project phases. The bank will seek to restore the biologic and hydrologic functions of the area. This would be done through a conservation easement on the property, exotic vegetation removal and replanting, removal of unnatural physical improvements such as roads and canals, hydrologic improvement and threatened and endangered species enhancement. At this time, Phase 1 has been completed and permitting of

Phase 2 is in progress. The FPL Mitigation Bank is located within the proposed project area of the C-111SC Western Project. Any possible hydrological effects such as increased hydroperiod and stage that would occur within these lands as a result of the proposed project would be beneficial. Any increase in hydroperiods of these lands would only serve to increase intended ecological functions.

RMC South Florida, Inc. Mitigation Area

RMC South Florida, Incorporated owns and operates rock mines between U.S. Highway 1 and Card Sound Road, south of Florida City. As mitigation for the rock mines, approximately 1,147 ac in the northern part of the Model Lands, north of the mining operation are to be restored. The focus would be on removal of a large concentration of invasive or exotic vegetation. Hydrologic improvements are needed in the area, but would not be significantly achieved as part of the mitigation plan. The RMC Mitigation Area (Figure 15) is located within the proposed project area of the C-111SC Western Project. Florida International University (FIU) would aid in the planning and monitoring of the restoration. Following the initial restoration, it is planned that FIU will receive the land through a donation. FIU would then be responsible for the long-term maintenance of the area as required by the permit.

IV. EVALUATION METHODOLOGY

A. Modbranch Model

The C-111SC Project required investigation of both surface and groundwater flow to evaluate the effectiveness and flexibility of proposed project features. Groundwater models are widely used as simulation tools for analyzing the subsurface systems including complexities in the horizontal and vertical extents. Surface and groundwater flow modeling was performed for the hydrogeologic system in the project study area footprint using a coupled ground- and surface-water model (Modbranch), developed to estimate ground-water flow and to simulate the hydrologic conditions in the surrounding area. Data on hydraulic conductivity, topography, subsurface layer elevations, sources and sinks, and boundary conditions was incorporated from the data available with the existing sub-regional Modbranch model. The model domain was placed within the project study area based on the realistic representation of the lithologies as defined by the existing sub-regional Modbranch model.

B. Project Performance Measures and Criteria

Benefit Evaluation Methodology

The benefit evaluation methodology relied upon Greater Everglades conceptual ecological models as a framework around which the PDT evaluated the ecological consequences of project alternatives. Specifically, the subset of Greater Everglades ecosystem conceptual ecological models identified as being relevant to the study area by the PDT are as follows: (1) Everglades Ridge and Slough Conceptual Ecological Model (Ogden 2005); (2) Southern Marl Prairies

Conceptual Ecological Model (Davis et al. 2005); (3) Conceptual Model of Ecological Interactions in the Mangrove Estuaries (Davis et al. 2005); and (4) Conceptual Ecological Model of Florida Bay (Rudnick et al. 2005).

The ecological evaluations of project alternatives require a general understanding of conditions reasonably anticipated to exist in the absence of project-related activities (*i.e.*, the future without-project condition), and those that might be expected with each of the project alternatives (*i.e.*, with-project conditions). Performance measures (PMs) associated with the above-referenced conceptual ecological models, developed by the CERP RECOVER Evaluation Team for application with the South Florida Water Management Model (SFWMM) were reviewed for applicability to this project's study area and modeling strategy. Specifically, those PMs included:

- GE-1: Number and Duration of Dry Events for Shark River Slough
- GE-2: Inundation Pattern in Greater Everglades Wetlands
- GE-3: Extreme High and Low Water Levels in Greater Everglades Wetlands
- SE-1and 5: Southern Coastal Systems Salinity PM
- SE-3: Southern Coastal Systems Everglades Water Levels

Due to differences in hydrologic model codes between the SFWMM and Modbranch, the model scale (regional versus local, respectively), the temporal and spatial resolution (coarse versus fine, respectively), and simulated period of record (36-year continuous versus three individual average, wet, and dry-year simulations, respectively); it was recognized that PMs conceptualized for application with the SFWMM could not be used directly with the Modbranch model. As such, the PDT developed PMs capable of measuring the ecologically-significant hydrologic stressors of the RECOVER performance measures, but at a scale and in a manner more appropriate for the finer-resolution, basin-specific Modbranch model application.

Because the primary objective of this project is to improve the timing and distribution of freshwater discharges to Florida Bay via improved retention of water lost as seepage from Taylor Slough to the C-111 canal, PMs designed to detect intended and unintended impacts within the study area associated with greater retention of water in eastern ENP were applied during alternative evaluations. The applied PMs identified and measured changes in timing of overland flow distributed to Taylor Slough, and hydroperiods and water depths/stages within the study area. The PMs applied during evaluation of management measures include the following:

- PM 1.5 Sheetflow timing and distribution
- PM 2.4 Stage-inferred coastal zone salinities
- PM 2.1 Hydroperiod-inferred vegetation communities

As presented by the conceptual ecological models, relationships exist to varying degrees between hydrologic conditions, nutrient availability, vegetation communities, and habitat utilization by fish and wildlife. However, *a priori* selection of target vegetation community "end states" and habitat function can yield multiple site-specific target conditions that may not be fully compatible with one another. The PDT recognized that establishing harmonious targets of spatial distribution of vegetation communities and associated habitat functions would be difficult due to complications associated with the study area such as: relative lack of topographic relief;

presence of a saline boundary condition; accuracy and precision limitations of available field and input data; accuracy and precision limitations of the employed hydrologic model codes; and relative sensitivities of ecological processes to minor changes in water levels and water quality and salinity. As such, the PDT elected to develop a pre-drainage hydrologic computer model to better understand how the study area might respond to rainfall in the absence of managed features (*e.g.*, canals, levees, water control structures, and water well withdrawals were removed; all other model parameters, topographic input, and rainfall inputs remained the same).

As discussed previously, the Modbranch model was configured to represent three individual one-year simulations (*i.e.*, an average year, a dry year, and a wet year). Results of the average, dry, and wet-year pre-drainage simulations were reviewed by members of the PDT who interpreted them to be generally reflective of historic or pre-drainage conditions. The PDT determined that the hydrologic conditions resulting from the Modbranch simulation of a passive, pre-drainage landscape's response to precipitation would serve as appropriate target conditions. The indicator regions for the entire study area are shown below in Table 2 and Figure 4.

Description of Performance Measures

PM 1.5 Flow Timing, and Distribution of Volume

The sheetflow timing and distribution PM was designed to characterize how much of the freshwater discharge flowing to tide from the Everglades is concentrated at Taylor Slough (*i.e.*, moving toward central Florida Bay) and when during the year the discharges are occurring. This PM was applied to a total area of 98,500 ac located in Little Madeira Bay, Northeast Florida Bay, and Taylor Slough. An artificial flow transect was established perpendicular to the direction of Taylor Slough discharge inland from the coastline. Time series of fresh water discharges from the study area to tide, and across the Taylor Slough transect were synthesized from the Target, Baseline, and Project Alternative simulations using scripts and programs prepared by the Modbranch modeler(s). Those time series were processed in an Microsoft Excel workbook using a combination of VisualBasic macros and cell-based formulae to determine the deviation of the Baseline and Project Alternative conditions from the Target condition with the objective of minimizing each alternative's deviation from the target condition (in terms of discharge timing, and fraction of total discharge to tide made across the Taylor Slough transect). The resulting measure of agreement with the Target condition was expressed as an index of 0.0 to 1.0 (with 1.0 representing an ideal match to the target, 0.0 representing little or no resemblance to the target condition) for the Baseline condition and each Project Alternative condition. To arrive at a measure-specific computation of habitat units, the resulting measures of sheetflow function were multiplied by the combined acreage of Taylor Slough and Central Florida Bay. The raw model output, the spreadsheets, the processed model output, and associated indices and habitat unit computations were presented to and reviewed by the PDT during its assessment of project alternatives.

PM 2.4 Coastal Zone Salinities

The stage-inferred coastal zone salinities PM characterizes how coastal embayment salinities vary during the year as estimated using stage-salinity relationships described by existing stage-based salinity regression equations provided by ENP. Stage time series were synthesized from the Target, Baseline, and Project Alternative simulations using scripts and programs prepared by the Modbranch modeler(s). Those time series were processed in a Microsoft Excel workbook using a combination of Visual Basic macros and cell-based formulae to determine the deviation of the Baseline and Project Alternative conditions from the Target condition with the objective of minimizing each alternative's deviation from the target condition (in terms of salinity-duration; the fraction of each year spent within a certain range of salinities). The resulting measure of agreement with the Target condition was expressed as an index of 0.0 to 1.0 (with 1.0 representing an ideal match to the target, 0.0 representing little or no resemblance to the target condition) for each coastal embayment for the Baseline condition and each Project Alternative condition. To arrive at a measure-specific computation of habitat units, the resulting measures of salinity-related habitat function were multiplied by the acreage of the corresponding embayments. This performance measure was applied to an area of 27,300 ac located in Long Sound, Joe Bay, Little Madeira Bay, Manatee Bay, and Barnes Sound. The raw model output, the spreadsheets, the processed model output, and associated indices and habitat unit computations were presented to and reviewed by the PDT during its assessment of project alternatives.

PM 2.1 Vegetation Hydroperiods

The hydroperiod-inferred vegetation communities PM characterizes annual hydroperiods within defined indicator regions across the entire study area by describing how much of each indicator region (*i.e.*, percent area) experiences a given hydroperiod (*i.e.*, of 0 to 365 days; divided generally into 30-day hyderopriod classes or groupings). Hydroperiod outputs were synthesized for each model cell within the study area using scripts/programs prepared by the Modbranch modeler(s). Those outputs were summarized by indicator region and expressed as "percent area" experiencing a hydroperiod within a certain hydroperiod range (*e.g.*, 10 percent experienced a hydroperiod of 1 to 30 days; 5 percent experienced a hydroperiod of 31 to 60 days, etc.). Those indicator region-specific hydroperiod distributions were processed in a Microsoft Excel workbook using a combination of Visual Basic macros and cell-based formulae to determine the deviation of the Baseline and Project Alternative conditions from the Target condition with the objective of minimizing each alternative's deviation from the target condition (in terms of percent area experiencing each hydroperiod class). The resulting measure of agreement with the Target condition was expressed as an index of 0.0 to 1.0 (with 1.0 representing an ideal match to the target, 0.0 representing little or no resemblance to the target condition) for each indicator region for the Baseline condition and each Project Alternative condition. To arrive at a measure-specific computation of habitat units, the resulting measures of hydroperiod-related (*i.e.*, vegetation community relative abundance within the indicator region) habitat function was multiplied by the acreage of the corresponding indicator region. This performance measure was applied to an area of 155,110 ac, which represents the entire area of wetland landscape identified in Table 2 (Indicator regions 1A-D, 2A-D, 3A-D, 4A-D, 5A-D, and 6A-D) as well as

Taylor Slough. The raw model output, spreadsheets, processed model output, and associated indices and habitat unit computations were presented and reviewed by the PDT during the assessment of project alternatives.

Aggregate Benefit Calculations

To develop an aggregation of individual performance measures for the target, baseline, and each project alternative condition, the measure-specific habitat unit computations were added together and normalized to correct for double counting of affected areas by two or more of the individual PMs. The resulting combined and normalized habitat unit scores and the associated spreadsheet were presented to and reviewed by the PDT during its assessment of project alternatives.

The PDT's evaluation of project alternatives was based on evaluation of the aggregated habitat unit computations. The PDT elected to not apply subjective weights to restoration priorities (*i.e.*, a determination that some landscapes take priority over others and some measures of ecological performance are more significant than others). The Benefit Evaluation Methodology results are presented in Table 5.

Cape Sable Seaside Sparrow Performance Criteria

General Background

The CSSS is currently distributed as six subpopulations (A-F) in the Southern Everglades. Subpopulations B, C, and D are located in the C-111SC Project study area (Figure 15). Subpopulation B is located south of S.R. 9336 and Long Pine Key between Shark River Slough and Taylor Slough. Subpopulation C is located just north of SR9336 on the eastern boundary of ENP. The majority of subpopulation D is located just west of the C-111SC and east of the Aerojet Road, southwest of the junction of theC-111 and C-111E canals (Figure 14).

Nest height above ground surface

CSSS can nest between February and July (Service 1983) but the majority of nesting occurs in the dryer spring season. Nests are constructed 17 to 21 cm off the ground (Lockwood et al. 2001) and preferably in mixed marl prairie habitat. Pimm et al. (2002) estimates the nest cycle of CSSS to range from 34 to 44 days, when totaling the number of days required for all the nesting stages (egg laying, incubation, nestling, and fledgling). If water levels rise above the mean height of the nests during this period the sparrow will cease breeding (Lockwood et al. 1997; Lockwood et al. 2001; Basier et al. 2008; Cade and Dong 2008). For purposes of this evaluation the applied metric was the number of ac within each individual sparrow subpopulation in which the maximum water depth (above ground level) exceeded 20 cm for 1 day or more during the period from March 15 to June 30 during each year analyzed (average, dry, and wet). A secondary metric was computed using this data and totaling the ac that exceeded the 20 cm criteria for more than 30 days. This metric is consistent with one of the primary constituent elements published for the CSSS in the revised critical habitat designation in 50 FR, 62736.

Water level below ground surface

A measure of the potential for sparrow nesting success is the number of consecutive days between March 1 and July 15 that water levels are below ground surface. This range of dates incorporates most of the time-frame when sparrows have been observed nesting (Lockwood et al. 1997; Lockwood et al. 2001) and is an indirect measure of the number of days potentially available for sparrow courtship and nesting (Van Lent et al. 1999; Lockwood et al. 1997; Lockwood et al. 2001). Modeling of sparrow reproductive potential (Pimm and Bass 2001; Walters et al. 2000) supports the general recommendation for evaluation of nesting condition availability, which states that forty consecutive days for 8 out of 10 years is considered favorable for CSSS population persistence, 40 days for 7 out of 10 years is considered borderline for persistence, 80 days for 7 out of 10 years is favorable, and 80 consecutive days for 8 out of 10 years is considered very favorable. For purposes of this evaluation the applied metric was the number of ac within each individual sparrow subpopulation meeting greater than an 80 day continuous dry period (water level below ground), between March 1 and July 15 during each year analyzed. A secondary related metric was the area weighted average number of days exceeding the 80-day threshold during that time period.

Water level above ground surface

CSSS nesting habitat studies indicate the sparrow shows a preference for nest sites that provide specific vegetative characteristics (Basier et al. 2008). Nests are built where vegetative litter is moderately high (25-50 percent). The presence of specific grasses such as *Muhlenbergia filipes*, *Schizachyrium rhizomatum*, and *Schoenus nigricans* also appear to be cues for nest placement. These species show an optimal preference for sites that characteristically have a discontinuous hydroperiod (water above ground level) in the range of 60 to 180 days. Habitat averaging longer hydroperiods than this range are generally dominated by species such as sawgrass. The applied metric was the number of ac within each individual sparrow subpopulation meeting the 60 to 180 day discontinuous hydroperiod (water level above ground) window during each year analyzed. A secondary related metric was the area-weighted average number of days meeting the 60 to 180 day discontinuous hydroperiod window.

Tables 6 through 9 present the data results processed using the above metrics for the CSSS for each subpopulation for the years analyzed and comparing the present condition results (Modbranch model run of Initial Operating Regime (IORLO2) to the with the with-project condition results (Modbranch model run of Initial Operating Regime with the recommended alternative 2Ds (IORLO2_2Ds) is presented in Tables 6 through 9.

Spatial analysis of this data was also conducted to gain insight into project impacts on sparrows. The data is illustrated in Figures 16 through 24, for all acreage contained within the entire project study area as well as for sparrow critical habitat. These figures facilitated an analysis not only of the distribution of impacts within current sparrow habitat, but also insight into whether the project could have negative or positive effects on potential CSSS habitat throughout the project study area.

Wading Bird Performance Criteria

A primary goal of Everglades restoration is the sustainability of healthy wading bird populations (Corps 1999). Response of wading birds to hydrologic conditions can be used as a tool to establish hydrologic targets for restoration. The response by wading birds will, through time, serve as a valuable indicator for assessing the progress of restoration. Depth and the drying process, known as recession rate, that affects fish availability are the hydrologic variables considered important for wading bird suitability. Many studies show that fish populations are much higher in marshes that are continuously inundated than in areas that dry out regularly (Loftus and Eklund 1994). There is a difference between processes that enhance overall fish population size and those that create high densities of fish in small patches at the scale at which wading birds are feeding. Water depths can be too deep during much of the year when fish populations are growing, to be efficiently accessed by birds. Often, the most ideal foraging conditions occur for wading birds when the marsh surface is almost dry and fish are experiencing high mortality in shallow pools. When feeding, it is more important for wading birds that conditions for high fish mortality occur, than conditions for high fish production. Fish populations usually rebound rapidly subsequent to a drydown, but most importantly, receding water levels during the dry season, occurring over small depressions in the marsh surface, create small patches of shallow water with exceptionally high concentrations of fish; many times higher than densities due to extended hydroperiod. Fish concentrations increased by a factor of 20 to 150 during a seasonal drydown in the Everglades and Big Cypress National Preserve (Carter et al. 1973; Loftus and Eklund 1994; Howard et al. 1995).

Individual fish are more vulnerable to capture and wading bird feeding success increases when patches of concentrated prey are found in shallow water with sparse vegetation (Kushlan 1976). Wading birds have adaptations such as white plumage and social foraging that allow them to minimize their search time even though these high-density food patches can be scattered in the landscape (Kushlan 1981; Erwin 1983). Thus, at the landscape scale, wading birds are able to exploit small patches of highly available prey and large foraging aggregations indicate good feeding conditions. High water levels at the end of the wet season and low water levels at the end of the dry season (hydrologic patterns that produce the maximum number of these patches with high prey availability) are very likely to produce good nesting effort for these species (Smith and Collopy 1995). The location of wading bird nests has shifted from the coastal to the interior Everglades over the past 70 years suggesting a possible change in the availability of prey between the coastal and interior regions.

The wading bird suitability index utilized for the wading bird performance criteria is based exclusively on the physical processes that concentrate aquatic prey and make them susceptible to feeding by wading birds. The index is based on the work of Gawlik et al. (2004) and is detailed in Appendix A. The index is aggregated up to the landscape scale for weekly time steps. For purposes of the analyses used in this report these weekly time steps have been grouped into monthly steps. For each grid cell, the wading bird suitability index (SIWB) has one function for water depth (SIdepth) and one function for water recession rate (SIrecession) which are then combined by defaulting to the comparative lowest value, and sorted for the top 23 percent of these values for cells in each subregion. Twenty-three percent was chosen because studies have shown that approximately one-quarter of cells (or habitat) are occupied at any one time by feeding wading birds during a good nesting year (Gawlik et al. 2004; Bancroft et al. 1995). Finally, habitat units are calculated based on grid cell acreage and then summed. For further information, refer to Appendix A.

Data processed using the above metrics for wading birds for each ecological sub zone for the years analyzed and comparing present condition (Modbranch model run of Initial Operating Regime (IORLO2)) to the with project condition (Modbranch model run of Initial Operating Regime with the recommended alternative 2DShort (IORLO2_2Ds)) is presented in Tables 10 through 13.

Taylor Slough Flow Volume

One of the primary goals of the C-111SC Project is to increase flow volume in Taylor Slough and delivery of those flows to Florida Bay for restoration of associated estuarine and marine ecosystems. Modbranch model output of yearly total flow volume in acre-feet across modeled transects bisecting Taylor Slough was examined as part of this report to measure progress with the project towards that goal. Data processed using this flow volume metric was examined for a series of transects distributed from north to south (Figures 26 and 27) for the years analyzed and comparing present condition (as indicated by the Modbranch model run of Initial Operating Regime (IORLO2)) to the with project condition (as indicated by the Modbranch model run of Initial Operating Regime with the recommended alternative 2DShort (IORLO2_2Ds)) and is presented in Table 14.

V. FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

A. Introduction

Since the construction of the C&SF Project, the ecology of the proposed project area of the southeastern Everglades has been in decline (Corps 1999). The construction of the numerous drainage features has severely disrupted the hydrologic regime of the wetlands, causing a transition from an overland sheetflow system to one that moves water swiftly through conveyance features to point source discharge areas along Florida Bay.

Declines in ecological function of the Everglades have been well documented (Browder et al. 1994; Corps 1999; Johnson et al. 1988; Lodge 2005; Ogden 1994; Pimm et al. 2002; Van Lent and Johnson 1993; Van Lent et al. 1993). The deteriorating conditions in the proposed project area illustrate these declines. The altered hydroperiods of the area have led to declines in prey bases for numerous macrofauna including migratory birds. Untimely marsh dryouts deplete populations of fish and amphibians that are necessary to sustain the massive colonies of birds that used to inhabit the area. Fires that once would have contributed to a healthy pyrogenic system now serve only to burn off layers of organic material and detritus that is imperative to maintaining proper nutrient levels in an oligotrophic system. The resulting soil subsidence severely alters the composition of plant species in the natural communities, increasing the likelihood of invasion by aggressive, exotic vegetation.

The changes in the hydrology of the freshwater systems have also led to secondary effects on the estuarine and marine environments of Florida Bay. Damaging freshwater pulses from the C-111 canal and tributaries disrupt flow patterns of Florida Bay and create an unnatural salinity envelope along the shorelines and farther into the Bay. These dramatic salinity changes have drastic negative effects on nursery areas for fish and invertebrate residents of the estuaries (Serafy et al. 1997).

The disturbing trends in the Everglades will continue to worsen if the problems are not confronted. The effects that are occurring will not only be seen though the loss of aquatic-dependent wildlife. Significant adverse impacts to commercial, recreational, and other economic activities are already occurring and will only increase in intensity.

A variety of privately-owned, local, State, and federally-owned lands are contained within the study area for the proposed C-111SC Project. Privately-owned natural lands in south Florida have become scarce due to development; therefore, the Service anticipates that these lands will be developed in the near future. Native forested-shrub wetlands and graminoid marshes south of SR9336 and east of Card Sound Road not in public ownership will likely be developed in the future. Future development would also have secondary effects by altering the surrounding water quantity, quality, timing and distribution. The wetlands in the northern part of the sawgrass marshes in the Southern Glades and Model Lands could transition from a sawgrass-dominated marsh to cattail-saltbush-dominated wetlands due to poor water quality from residential runoff and decline of available freshwater.

A reduction of the wetland function and value of coastal, inland, and overall fish and wildlife habitat within the study area would be adversely impacted by any or all of the following: future residential, commercial, and industrial development. Residential development within the project area would require the dredging and filling of wetlands. The creation of stormwater detention areas and drainage infrastructure would have a detrimental effect on groundwater flow into Florida Bay, and Barnes and Card Sounds. Freshwater groundwater flow into these areas is necessary to maintain existing salinity regimes in the dry season and reduce hypersalinity levels that already exist. Changes in availability and distribution of freshwater and further disruption of natural sheetflow from discontinuities in hydrology due to levees, roads, and canals will further exacerbate the changes occurring in the natural freshwater graminoid marshes, forested-shrub wetlands, marl prairie, tree island, and mangrove ecotones. Disruption of the natural hydrology has resulted in aquatic vegetation community changes and a resultant disruption of aquatic productivity and function that has had repercussions throughout the food chain, including effects on wading birds, raptors, larger predatory fishes, large reptiles, and mammals. Productivity of native fish species, which serve as prey species for wading birds has been, and will continue to be, depressed due to water management practices (Ogden 1994) and other factors previously discussed. These effects will worsen given demands associated with environmental changes for the next 50 years.

Urbanization is normally accompanied by an increase in runoff of a wide range of pollutants including herbicides, pesticides, fertilizers, aromatic compounds (oils, gas), heavy metals, and other EPOCs (hormones, organic, and inorganic compounds). In urban developments near wetlands, residents often request and obtain mosquito spraying. Agricultural development is also typically accompanied by the use of herbicides, pesticides and fertilizers. The increased release of pollutants into the natural environment would result in the decline of macroinvertebrates (insects, snails, etc.), which in turn would adversely impact native resident and migratory birds, as well as other insectivores. Additionally, foraging opportunities for wildlife would be reduced as native plant communities would be replaced with ornamental species in developed areas. Increased development within this area would also lead to habitat fragmentation, and a loss of wildlife corridors that are critical for larger animals such as the Florida panther.

Portions of the project area have high all terrain vehicle (ATV) usage and this is likely to increase in the future without project scenario. The impacts resulting from unauthorized ATV usage in the natural areas include disturbing the vegetation and microtopography of the area. This has implications for the hydrology and vegetation, which are sensitive to slight changes in topography on the scale of inches. ATV usage and its associated detrimental effects to the environment, will likely increase with the anticipated increase in population in or near the project area.

Sea level rise will create the potential for further expansion of salt tolerant plant species, especially mangroves, into the freshwater marsh areas. Disruption of natural fire cycles and extent can have several effects that will increase in the future without project scenario. Control of fire intensity and extent due to potential for impacts on human infrastructure can encourage establishment of woody plant species that would normally be eliminated as well as selection against more fire tolerant species such as sawgrass and muhly grass (*Muhlenbergia capillaries*). Reduction of water availability can cause fires to burn more intensely than natural, killing plant species that would normally survive a more natural "cool burning" fire as well as permitting organic soils to burn. Concurrently, unnatural flooding can inhibit fires and beneficial vegetation changes. All of these processes will be exacerbated due to increased urbanization in the future.

B. Threatened and endangered species

Without the environmental benefits of the C-111SC Project, urbanization, water demands, direct loss of habitat, and other demands for land, as well as degradation of existing habitat function will likely result in a continued decline in populations of threatened, endangered, and State listed species of special concern in the project area during the next 50 years.

The sparrow is endemic to the Everglades and relies exclusively on short-hydroperiod freshwater marl prairies. Between 1981 and 1996, the sparrow experienced dramatic declines including theCassey et al. (2007) and Pimm et al. (2002), showed that the sparrow experienced dramatic declines in occupancy between 1981 and 1996, including the near extirpation of two of the six CSSS subpopulations (subpopulations A and D), Pimm et al. (2002) and Cassey et al. (2007). Intensive Greatly increased management of d water flows in those years that precluded sparrow breeding, and greatly altered available habitat, and has have been responsible for these declines (Nott et al. 1998; Jenkins et al. 2003). Survey results from 1992 indicated a range-wide decline in sparrow occupancy as compared to their distribution in 1981, with a major decline observed within subpopulation C and relatively large declines observed within subpopulations D and F (Cassey et al. 2007). A notable decline was observed between 1992 and 1995 in subpopulation A (Curnutt et al. 1998). The persistent unnatural flooding during consecutive breeding seasons is believed to have caused this subpopulation to decline substantially in occupancy and numbers, leading a change in water management so that less water was delivered into subpopulation A during the peak of the sparrow's breeding season (Pimm et al. 2002; Walters et al. 2000). While these management efforts appear to have resulted in stable sparrow occupancy of subpopulation A since 1996, the sparrow shows little sign of recovering to pre-1990 occupancy levels (Cassey et al. 2007).

The loss of subpopulations exposes the entire species to greater risk of extinction. Failure to observe significant recovery in small sparrow subpopulations suggests that limiting factors may become apparent when sparrow numbers are driven to excessively low levels (Morris and Doak 2002). For example, disrupted behavioral and social mechanisms may limit the ability of small subpopulations to rapidly recover even though habitat is available (Sutherland 1998). For many years, demographic information from these small subpopulations was unavailable and thus there was no way to identify the key factors that were operating to limit sparrow recovery. Current water management practices effects CSSS breeding success and without a change such as a scenario without CERP and the C-111SC Project, will restrict management options for the recovery of this subspecies in the future will be severely restricted.

Florida panther habitat in the C-111SC Project area includes habitat designated as primary zone in the Landscape Conservation Strategy for the Florida Panther in south Florida (Kautz et al. 2006). The primary zone is considered to be the most important area needed to support a self-sustaining panther population. Environmental factors affecting the panther include: habitat loss and fragmentation, contaminants, prey availability, human-related disturbance and mortality, disease, and genetic erosion (Dunbar 1993). Present and probable future population growth, urban expansion, and agricultural expansion in south Florida, including the project area, may compromise the ability of natural habitats to support a self-sustaining panther population. A future without C-111SC Project implementation may hinder Florida panther recovery and the Landscape Conservation Strategy for the Florida panther in south Florida.

The prognosis of the wood stork population in the United States over the next 50 years is partially dependent on the success of CERP. In a future without project condition, wood stork habitat will be eliminated by development or will continue to be degraded as foraging habitats in much of the remaining wetlands. As discussed previously, core feeding areas of two wood stork colonies overlap portions of the project study area. Continued urban development and disruption of the natural hydrologic cycle that affects the abundance and availability of prey organisms in the project area under a future without project scenario will reduce or possibly eliminate this foraging area for wood storks. For wood storks and wading birds in general, a long-term scenario that does not include habitat restoration components of CERP currently being evaluated would result in a continued overall decline due to continued habitat encroachment and anthropogenic influences on water supply. Although nesting by the Everglade snail kite is rare in the project study area, they are occasionally observed foraging and could be affected by these same habitat declines.

The future of federally listed reptiles within the C-111SC Project study area is uncertain. As noted above, habitat loss due to development and water management practices along coastal areas has been and continues to be the primary factors endangering the American crocodile (Service 1999). A future without-project scenario would likely result in no improvement of juvenile crocodile habitat, and may result in further habitat degradation. Collisions with automobiles continue to be the major documented cause of mortality of crocodiles in Florida. A future without the C-111SC Project would likely witness continued mortality from automobile collisions, and the relative proportion of this type of mortality may increase due to higher traffic volumes associated with an increased south Florida population. Inclusion of wildlife crossings as part of the U.S. Highway 1 Improvement Project should have a positive effect in reducing crocodile road kill.

Because of its relatively large home range, the eastern indigo snake is especially vulnerable to habitat loss, degradation, and fragmentation caused by residential and commercial construction and agriculture (Lawler 1977; Moler 1985). Urban and agricultural development interests would continue to degrade or eliminate large expanses of suitable habitat throughout the project area under the future without project scenario. Even with continued habitat destruction and alterations, this species will probably persist in most areas if large, unfragmented pieces of suitable habitat exists (Service 1999). However, continued habitat fragmentation may result in isolated small groups of indigo snakes that cannot ensure the continuation of viable populations.

C. Non-native flora and fauna

An increase is anticipated in the 2050 future-without project scenario in the spatial coverage of invasive non-native plant species, such as Brazilian pepper and Australian pine due to land disturbance and projected lower water levels. With the lack of monitoring and maintenance, there will also be an increase in other non-native plants including shoebutton ardisia (*Ardisia elliptica*) and old world climbing fern (*Lygodium spp.*). The spread of all these invasive non-native plant species has resulted in the conversion of large acreages with a variety of native vegetative species to less diverse and in some cases mono-specific vegetative cover with reduced value as wildlife habitat (Corn et al. 1999; Brandt and Black 2001).

Introduction and spread of non-native fish species has increasingly been problematic in the project study area. The causative factors for this non-native fish problem include illegal introductions, unnatural habitat due to construction of canals and impoundments, and the establishment of vectors for travel and refugia (linear canals and deeper water) unlike the natural Everglades environment (Benson et al. 2001). Some studies have reported that the effect of exotic fishes on native species is negative and will be exacerbated in the next 50 years (Turner et al. 1999; Trexler et al. 2000).

VI. DESCRIPTION OF SELECTED PLAN PROJECT AND OTHER ALTERNATIVES

A. Corps Restudy Report

Previous ecosystem restoration and water supply planning efforts have included the Corps' C&SF Comprehensive Review Study, Final Integrated Feasibility Report and Programmatic Environmental Impact Statement (Restudy) (Corps 1999). The C-111SC Project was one of the ten projects conditionally authorized for implementation by Section 601(b)(2)(C) of the WRDA 2000. The purpose of the C-111SC Project as stated in the Restudy was to "improve deliveries and enhance the connectivity and sheetflow in the Model Lands and Southern Glades areas, reduce wet season flows in C-111, and decrease potential flood risk in the lower south Miami-Dade County area."

The specific components of the C-111SC Project based on the Restudy plan (Figure 1) are: (1) increasing the pumping capacity of the proposed new S-332E pumping station to 500 cfs from 50 cfs; (2) relocating the proposed new C-111N spreader canal to SW 432nd Street; (3) construction of a culvert under U.S. Highway 1 to extend the spreader canal eastward; (4) adding an additional culvert under Card Sound Road; (5) extension of the proposed new C-111N spreader canal through the triangle area of Model Lands, east of Card Sound Road; (6) backfilling of the existing C-111 canal south of the confluence with C-111E to S-197; (7) removal of associated C-111 levees and access roads; (8) complete backfilling of the C-110 canal and levee removal; and (9) creation of a stormwater treatment area in the triangle land between C-111 and C-111E.

B. C-111 Spreader Canal Western Phase 1 Project

The project objectives for the C-111 Spreader Canal Western Phase 1 Project are listed below:

- Restore the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough to historic levels derived from the pre-drainage model runs;
- Improve hydroperiods and hydropatterns in the Southern Glades and Model Lands. The hydroperiods will be improved to optimal levels to support historical vegetation patterns as derived from the pre-drainage model runs. Hydropatterns will be restored to historical sloughs and associated tributaries.
- Return coastal zone salinities to historical recorded conditions through the redistribution of water that is currently discharged to tide.

The Recommended Plan for the C-111SC Western Phase 1 Project includes the features associated with Alternative 2DShort (Figure 28). The Recommended Plan provides opportunities to reduce the decision-critical uncertainties needed to recommend a full-scale spreader canal, and other C-111SC Eastern Phase 2 features. The Recommended Plan (Alternative 2DShort) is intended to improve the quantity, timing, and distribution of water delivered to Central Florida Bay via Taylor Slough. It is anticipated that these improvements can be realized through the establishment of a hydraulic ridge between Taylor Slough and the C-111 canal to reduce seepage loss from Taylor Slough, and its headwaters. The focus of this plan is to: (1) evaluate system-wide responses; (2) evaluate critical project uncertainties to changes in the intended reduction of seepage losses from Taylor Slough; (3) record ecological responses to these changes; and (4) evaluate the resulting flood control responses of the drainage system. Information gained from this restoration effort will provide valuable information for the planning and design of a spreader canal system to replace the existing C-111 canal.

The hydraulic ridge will be established by combining operational changes within the lower C-111 canal (south of S-177), and the diversion of water that is currently being discharged through S-177, S-18C and S-197 to the existing Aerojet Canal, and an above ground infiltration basin, (FPDA) to be constructed within the District owned Frog Pond lands. Marsh stage triggers in Taylor Slough, and elsewhere in the adjacent basin, will be used to manage pumping rates, and the distribution of water to offset the seepage affects of the lower C-111 canal system. Creation of this hydrologic ridge will be accomplished by installation of additional intermediate water control structures on the lower C-111 canal and operational changes at S-18C and S-197 structures to increase the effective water control elevation of the lower C-111 canal. These intermediate structures and operational changes will facilitate reducing the seepage losses from Taylor Slough and increase the net water distributed west of the existing C-111 canal system. In addition to the two features described above, Alternative 2DShort includes at least one new operable structure in the lower C-111 canal just south of the existing S-18C structure (two operable structures were suggested in the Recommended Plan, but a design has not yet been chosen), a plug at S-20A, and operational changes at S-20 (both located on L-31E) (Figure 28).

Recommended Plan Elements

The C-111SC Phase 1 Project Recommended Plan is Alternative 2DShort and includes the following features:

- Frog Pond Infiltration Basin
- Aerojet Canal
- Intermediate Water Control Feature
- Incremental S-18C Changes
- L-31E Canal Plug and Operational Change at S-20A
- C-110 Canal Plugs

The Frog Pond Infiltration Basin and Aerojet Canal feature are intended to work in unison to create an approximately nine-mile hydraulic ridge. The ridge will serve to block groundwater flows from moving into the C-111 canal, therefore retaining water in Taylor Slough and improving the quantity, timing, and duration of flows into Florida Bay. The remaining features of the Recommended Plan will serve to provide a jumpstart to environmental restoration in the Southern Glades and Model Lands.

Frog Pond Infiltration Basin

As planned, a 225-cfs pump station, to be constructed downstream of S-176, will route excess water, which would otherwise be discharged down the lower C-111 canal via S-177, to an approximately 530 ac (interior surface area) above ground detention area to be constructed within the southern portion of the District owned Frog Pond Lands.

The detention area will have an integral cascading header canal, which will stage up approximately 2.5 ft above existing ground level before "feeding" the three cells, which will make up the detention area. Weirs will be constructed between the header canal and receiving cell to ensure that the header stage rises meaningfully prior to discharging to the reservoir cells. A series of cascading weirs will be constructed within the header canal to ensure that potentiometric heads are maximized. The header cell will be fed by a lined conveyance channel (alternatively pipes) located along the northern limits of the reservoir. The 225-cfs pump station will consist of three 75-cfs pumps to allow stepped operations. In order to prevent overflowing, pumping will be discontinued if the elevation of the header canal exceeds 2.5 ft above the existing ground. Pumping will also cease if ponding within CSSS subpopulation C reaches a depth of 10 cm during March 1 to July 15, as measured at a pre-determined representative location.

Aeroject Road Canal

A second 225-cfs pump station, will be constructed immediately upstream of S-177, downstream of SR 9336. This pump station will work in tandem with the FPDB, will mirror the FPDB pump's operations, and water that would otherwise be discharged via S-177 would be routed to the existing Aerojet Canal via a northerly extension of the canal, or via the existing L-31W Canal. Similar to the FPDB's header cell, potentiometric heads within the Aerojet Canal and their effect in surrounding marshlands will be investigated through the use of cascading weirs or containment of canal water through perimeter berming. Similar to the FPDB pump station, pumping will be discontinued if the elevation of the canal exceeds 2.5 ft above existing ground. Pumping will also cease if ponding within CSSS Sub-population D reaches a depth of 10 cm (during March 1 to July 15), as measured at a pre-determined representative location. An appropriately sized pump station would be constructed, south of SR 9336, just upstream of S-177 to maximize the hydraulic ridge between S-177 and S-18C, which is reportedly the leakiest section of the C-111 Canal system.

Once the Aerojet Canal has reached some equilibrium with marsh stage triggers in Taylor Slough and adjacent marsh areas, or as additional water becomes available upstream of S-177, excess water (which would have otherwise been discharged via S-177) would be routed to the proposed FPDB via an appropriately sized pump station constructed downstream of S-176. The combined effects of the FPDB and Aerojet Canal hydraulic ridge would extend the effective seepage control between S-176 and roughly S-18C. As currently envisioned, the infiltration basin would utilize cascading cells, and no cell would be allowed to achieve a surface water stage more than 2.5 ft above the cell's average natural ground elevation.

Intermediate Water Control Features

The plan also includes an operable "S-197 like" structure within the lower C-111 canal, located between S-18C and the theoretical confluence of the C-111 canal with a theoretical extension of the C-110 canal. The proposed structure, called S-198, is intended to reduce current levels of seepage from the lower C-111 canal, while preserving existing levels of flood damage reduction. The S-198 structure is intended to increase water levels upstream of S-18C and raise water levels in the marsh between Taylor Slough and the C-111 canal, and further reduce overall seepage losses towards the east. Although opportunities exist for optimizing their design and operations, for simplicity, this structure was modeled identical to S-197.

Incremental S-18C Changes

In order to maximize restoration opportunities, the plan includes incremental increases in the current open and close triggers at structure S-18C. Open and close triggers will be increased in increments of no more than 0.1 ft at any time and the total change in either trigger shall not exceed 0.4 ft. Stage override triggers (to be determined) will be established immediately downstream of S-177 and/or in the adjacent farm fields to establish a "backstop" at which S-18C triggers will return to their existing levels.

L-31E Canal Changes

The plan includes construction of a permanent plug at S-20A, and operational changes at S-20. The proposed plug near S-20A, and proposed operational changes at S-20, specifically raising the open and close triggers 0.5 ft, are intended to more closely mimic pre-drainage hydroperiods within the Model Lands.

C-110 Canal Changes

Finally, the plan includes construction of earthen plugs at key locations within the C-110 canal in order to promote sheetflow within the Southern Glades. As currently envisioned, at a minimum, nine plugs will be constructed at semi-regular intervals by returning the original spoil material that was placed along the excavated canal banks. Excess spoil not utilized in construction of the plugs will be placed into the canal to further promote sheetflow and to lessen the effects of any remaining canal segments. If suitable material is identified offsite, it may be used to supplement the existing fill, up to the degree necessary to entirely fill the canal.

Due to the high uncertainty of the impacts on the environment and regional flood control system associated with the first increment of restoration, implementation of the plan will itself be incremental and may include temporary construction features that will be adapted for further modification. Flexibility in the design and installation of water control features recommended in this plan will provide an opportunity to evaluate critical system responses such as ecological, flood control, and water supply.

C-111 Spreader Canal Design Test Project

The C-111 Spreader Canal Design Test Project (Design Test) is a pilot project level investigation that will be tested to determine the constructability and operation of a small-scale spreader canal concept and provide learning opportunities for decision making related to the feasibility of larger scale spreader canal implementation during the C-111 SC Project Phase 2. The proposed Design Test canal will begin where C-111E intersects 424th Street (Work Camp Road), and run approximately one mile east along 424th Street (Figure 28). This project will involve placing small temporary pumps at C-111E and 424th Street and constructing sections of both a conveyance canal and a spreader canal. To the extent practical, existing drainage features will be used with some improvements. Various pumping scenarios (including duration and ambient hydrological conditions) will be tested to determine their extent and effect on below and above ground water levels, acreage affected, infiltration rates, flow gradient direction, and water quality. The project duration is expected to be 2 to 3 years; 1 year of baseline monitoring plus 1 to 2 years of additional monitoring after the design test goes on-line. It is anticipated that this will be a temporary project, and will be dismantled if it cannot be incorporated into the full-scale C-111 Spreader Canal Project at the completion of design test monitoring. The Service completed their section 7 consultation on this project on June 30, 2009.

C. C-111 Spreader Canal Eastern Phase 2 Project

The spreader canal and pump will be used to determine the effects of a smaller scale spreader canal than was envisioned in the Yellow Book. The knowledge gained from analysis of the spreader canal will be utilized to optimize canal widening and extension through Incremental Adaptive Restoration in the C-111SC East PIR.

The C-111SC East PIR will include more details of the features east of C-111 and focus on additional improvements in the quantity, quality, timing, and distribution of flows needed to maximize overall restoration of the lower system. This will be done by enhancing the spreader canal by increasing conveyance capacity and possibly extending further east into the Model Lands. Other possible management measures may include:

- Backfilling, partially backfilling, or plugging lower C-111;
- Additional water quality treatment features; and,
- Removing control structures and other barriers to flow.

The full array of performance measures previously discussed will be used in the C-111SC East PIR to determine overall benefits to the project area. Benefits (habitat units) for both PIRs and the overall costs will be input into a cost effective incremental cost analysis to determine the preferred alternative.

VII. POTENTIAL BENEFICIAL AND ADVERSE EFFECTS OF THE PROJECT

The primary purpose of the C-111SC Western Project is to improve the quantity, timing, and distribution of water delivered to Central Florida Bay via Taylor Slough. It is anticipated that these improvements can be realized through the establishment of a hydraulic ridge between Taylor Slough and the C-111 canal which will reduce seepage from Taylor Slough, and its headwaters. The focus of this plan is to evaluate: (1) system-wide responses; (2) critical project uncertainties to changes in the intended reduction of seepage losses from Taylor Slough; (3) ecological responses to these changes; and (4) resulting flood control responses of the drainage system. Learning gained from this first restoration effort will provide valuable information for the planning and design of a spreader canal system to replace the existing C-111 canal including identification of ecologically significant benefits for future phases. The new water control facilities and modifications to the existing C&SF Project would continue to be implemented as part of the on-going C-111SCl Project.

Due to the high uncertainty of the impacts on the environment and regional flood control system associated with the first increment of restoration (Phase 1), implementation of the plan (Alternative 2DShort) will itself be incremental and may include temporary construction features that will be adapted for further modification. This will be a departure from the traditional construction methods which are normally designed with known capacities, dimensions, elevations, and operating costs. Flexibility in the design and installation of water control features recommended in this plan will provide an opportunity to evaluate critical system responses (ecological, flood control and water supply) without making capital improvements that could be underutilized. This strategy is consistent with the National Research Council's principals of Incremental Adaptive Restoration.

A. General Fish and Wildlife Effects and Benefits

1. Wetland Restoration

Taylor Slough is a deepwater flow way that is instrumental in delivering water to the mangrove wetlands and southern estuaries of ENP. The ability of Taylor Slough to retain the natural inflows and rainfall is imperative to maintaining the ecological health of the natural system. The Recommended Plan (Alternative 2DShort), will provide a means to improve the hydrological inputs to Taylor Slough and prevent seepage from being lost to the C-111 canal. The Plan will promote the restoration of vegetative communities and fish and wildlife habitat that is currently deteriorating within Taylor Slough and its tributaries. However, by diverting water from other areas into Taylor Slough there could be a trade-off with impacts to Southern Glades and the Model Lands.

The C-111SC Project is expected to improve freshwater flows into Florida Bay via Taylor Slough. A hydraulic ridge would be created in order to retain water in ENP that is currently lost to the C-111 canal due to seepage. The resulting restoration effects are a step toward the restoration of hydroperiods and hydropatterns in the Everglades. The improvement of habitat and functional quality would occur as the flora and fauna within the natural system respond to the restoration of a more natural hydrologic regime.

Additionally, the restoration of these areas would improve native plant and animal species abundance and diversity. By retaining more water in the natural system the prey base for some species would increase, leading to a population increase and greater opportunities for diversification of the native communities. The restoration of natural hydroperiods may decrease opportunities for colonization by invasive or exotic species of vegetation. Combined with ongoing projects that work to eliminate nuisance species, a greater abundance of native vegetation and more natural patterns and mosaics should be observed.

The Recommended Plan will also offer a jump-start for pending restoration through the Eastern PIR as well as provide the means to evaluate decision critical uncertainties to optimize forthcoming restoration plans. Impediments to flow will be constructed in existing canals that currently drain the wetlands of the southeastern portion of the Everglades. While raising hydroperiods for restoration in the project area, the plugs and other structures will provide valuable information through monitoring that will be used to guide further elimination of drainage canals in the Eastern PIR. Additionally, information gleaned from the monitoring will provide modelers with a basis for evaluating effects of the future spreader canal.

2. Estuarine Restoration

Estuarine resources in the project area would be positively affected by the restoration of a more natural freshwater flow regime feeding the nearshore zone. However, the re-establishment of the salinity regime to realize a complete restoration of fish and wildlife resources throughout the nearshore zone in the project area will require much more freshwater than is currently available, particularly during the dry season. Although estuarine ecosystems are designed to withstand seasonal variation in salinity, the pulsing or inundation by freshwater or, alternately, the elimination of variability because of the reduction of freshwater input are harmful to the health of the system. Reduction of point source discharges at major conveyance canals as a result of implementing the C-111SC Project will reduce the unnaturally large fluctuations in salinity near canal mouths, resulting in more stable salinity regimes in these areas, which will improve habitat for fish and invertebrates inhabiting the areas near the canal outlets.

B. Construction-Related Effects

During construction of the FPDA, Aerojet Canal improvements, pumping structures, plugs and other project features there will be disturbance to the project construction and staging sites on District lands including levees and canals associated with excavation, possible blasting, construction, filling, hauling, and equipment operations. The soil disturbance, potential runoff and sedimentation, noise, spill potential (fuels, oils, chemicals, etc.) effects can be reasonably contained with the proper safeguards. Vehicle and equipment activity traveling to and from the project site, noise impacts, staging, and disposal areas outside the project site add an additional layer of complexity to assessment of wildlife disturbance. Surveys and vigilance for sensitive species that could be disrupted by these activities including foraging snail kites, wood storks, Florida panthers and West Indian manatees; and nesting American alligators and eastern indigo snakes will need to be conducted prior to and during all phases of construction and operation. Timing of construction and related activities may need to be evaluated in light of the potential effects during periods when sensitive species are using the project study area for nesting and foraging.

C. Operational Effects

Pump stations will be constructed and operated in association with the FPDA, Aerojet Canal feature, the potential new S-198 structure, and the temporary pumping station that may be implemented as part of the C-111SC Design Test Project. The pump stations will operate to divert or redistribute water from C111 and C-111E to freshwater and tidal wetlands during much of the year. The operation of high-volume pumps to move water from major conveyance canals to the wetlands represents a potential threat to fish and other aquatic resources. Pumps can cause direct loss of fish, amphibians, invertebrates, and other aquatic life through impingement and entrainment. This project is proposing the installation of several pump stations that connect to canals and discharge to spreader systems or directly into wetlands. It is anticipated that an unspecified area of habitat located downstream of the spreader system will be altered to a different habitat type over time. The significance of this impacted area on fish and wildlife, including listed species, is unclear. In some areas such as sloughs, wetland, and estuarine habitats that are receiving additional flows and extended hydroperiod, it is anticipated to increase habitat value for fish and wildlife. In some areas that currently receive too much flow which effect the value of the habitat as foraging habitat for wading birds (such as the wetlands receiving flows from the segment of the C-111 canal directly upstream of the S-197), reduced flows due to diversion of those flows to other habitats will also be beneficial to wildlife. However, in areas such as the marl prairie habitat for the CSSS subpopulation D, which may be presently negatively affected by extended hydroperiod, increased flows may be detrimental.

Changing operations to raise stages at the S-18C and stage changes that may occur due to the potential construction and operation of S-198, may have beneficial effects on sloughs, wetland, and estuarine habitats that are receiving additional flows and extended hydroperiod, but may also be detrimental to the CSSS subpopulation D by further lengthening hydroperiods and resultant vegetative habitat shifts within critical habitat. Figures 18 and 24 graphically illustrate the hydroperiod changes in 1978 (average year) and 1995 (wet year) that the Modbranch model predicts will occur as a result of the initial operations regime with the proposed project. Changing operations to raise stages in the L-31E throughout the year may promote leakage through the L-31E and thus provide fresh water to the coastal creeks in addition to extended hydroperiod and depth in surrounding marshlands. In conjunction with planned improvements to the L-31E in the BBCW Project, this will enhance the use of the existing canal as a delivery system to the coastline instead of its use primarily to prevent saltwater intrusion and storm surges. The BBCW preferred alternative includes culverts in the L-31E levee to preferentially direct waters out of the canal to targeted coastal creeks and has also included in its footprint those freshwater wetlands inland of the L-31E levee that would see benefits via improved hydroperiods under this scheme.

Water diversion operations can cause the undesirable spread of non-native fish, such as the Asian swamp eel, butterfly peacock, and various cichlid species. However, many of these non-native species require relatively deep-water habitat, little of which is found in the wetlands of the project area. Due to the sensitivity of the habitat in the project study area, care should be taken in final project feature design and operation to protect against undesired spreading of non-native fish.

D. Water Quality

Pumping of water from the C-111E canal will distribute water into downstream marshes that may have detrimental effects to marsh communities and wildlife. Levels of total phosphorus concentrations documented by sampling in C-111E canal water (exceedance of 10 ppb) have the potential to stimulate cattail colonization of formerly oligotrophic marsh communities. In such cases the role of cattail can change from its natural function in the Everglades as an early colonizer of disturbed areas that is eventually replaced by other vegetation types such as sawgrass, to a long-term dominant in formerly oligotrophic marshes that have become eutrophic and form permanent stands (Davis 1994). If pumping of C-111E canal water and the resultant water mix with C-111 canal water results in higher phosphorus levels being discharged into downstream marshes, disruption of the natural vegetation community could occur.

Other constituents of concern could include endosulfan, copper, and selenium that have been detected either in past monitoring or current investigations related to planning for this project. These constituents have been documented at levels that could potentially be hazardous to fish and wildlife, primarily by bioaccumulation through the food chain.

For all of these constituents, the potential effects on vegetative communities and associated biota, either through eutrophication, sedimentation, or other toxic effects need to be closely monitored and controlled with recommended best management practices.

VIII. PREVIOUS SERVICE INVOLVMENT IN THE C-111SC PROJECT

On December 16, 2002, the Service sent a planning aid letter (PAL) to the Corps providing the Service's comments with regard to the Corps' May 7, 2002, public notice soliciting input on issues to be considered as the Corps developed its National Environmental Policy Act analysis of the C-111SC Project.

On September 9, 2003, the Service submitted performance measures to the C-111SC PDT for evaluation of project effects on wading birds, CSSS, eastern indigo snake, West Indian manatee, periphyton, American alligator, and American crocodile.

On September 9, 2003, the Service submitted performance measures to the C-111SC PDT for evaluation of project effects on the Florida panther.

On September 30, 2003, the Service sent a PAL to the Corps providing a summary of the Service's current assessment of the effects of the footprint of the project to species listed under the Act and their designated critical habitat.

On October 31, 2003, the Service submitted revised performance measures to the C-111SC PDT for evaluation of project effects on wading birds, CSSS, West Indian manatee, Florida panther, periphyton, exotics, aquatic fauna, American alligator, and American crocodile.

On February 12, 2004, the Service transmitted a letter to the Corps in response to the Corps' request for a list of threatened and endangered species and critical habitats that may occur within the C-111SC study area, concurring with the list of species provided by the Corps, and listing additional species and critical habitat that should be included in the consultation.

On March 22, 2004, the Service, PDT, and WASH123 (the Corps hydrologic model being considered for use at that time) modeling team participated in a teleconference coordinating evaluation criteria and model post-processing that would be needed to evaluate project effects.

On June 13, 2004, the Service submitted draft objectives and methodology for wetland and forested habitat assessment methodology to the project ecological sub-team, for use in baseline and post construction monitoring.

On August 12, 2004, the Service transmitted comments to the Corps in a PAL for the C-111SC l Project introducing the wetland quality assessment methodology and its possible use for project monitoring and responding to PDT questions about methodology, and recommending future steps to complete the project assessment.

On December 29, 2004, the Service participated in a C-111SC aerial helicopter field reconnaissance to delineate and update data relating to current vegetative ecological zones in the project study area.

On March 24, 2005, the Service sent a PAL to the Corps submitting the future without project condition, wildlife and environmental section for the Feasibility Scoping Meeting documentation.

On August 25, 2005, the Service submitted EC 3.3 CSSS Nesting Condition Availability and EC 3.2 Wading Bird Recession Rate and Foraging Habitat performance measures to the project PDT to be used as part of project alternatives evaluation.

On September1, 2005, the Service submitted CSSS Nesting Condition Availability and Wading Bird Recession Rate and Foraging Habitat performance measures post processing instructions to the Corps modelers to be used as part of project alternatives evaluation using the WASH123 model.

On November 22, 2005, the Service sent a PAL to the Corps providing the Service's recommendations to include a number of fish and wildlife enhancement features in the design and operation of the C-111SC stormwater treatment area or reservoir.

On January 20, 2006, the Service transmitted comments to the Corps in a PAL for the C-111SC Project recommending that the north alignment of the spreader canal appeared to provide the most restoration benefits to the project among the suite of alternatives. Additionally, the Service also recommended that given the cursory nature of the alternatives analysis, a more comprehensive look be taken at the full array of alignments, including options to adjust any specific alignment from its currently projected location, opportunities to reduce costs by maximizing use of public lands, and possibly even shortening the spreader canal.

On May 24, 2006, the Service provided comments to the District through the Dr Checks database on the C-111SC Project Basis of Design Report prepared by the District contractor.

On June 27, 2006, the Service provided comments in response to the District back check comments through the Dr Checks database on the District's C-111SC Project Basis of Design Report.

On July 24, 2006, the Service provided recommendations for corrections in habitat areas delineated for threatened and endangered species delineated in the C-111SC Project Basis of Design Report.

On August 15, 2007, Service biologists, the project biologist from Miami-Dade Department of Environmental Resources Management and members of the Habitat Evaluation Procedure development team conducted baseline field sampling of aquatic invertebrate abundance and quality in project areas anticipated to be impacted by alternatives.

On December 28, 2007, the Service sent a letter to the Corps in response to their invitation to be a cooperating agency as part of the preparation of the C-111SC Project EIS.

On April 29-30, 2008, Service biologists, PDT members and CSSS researchers conducted a field survey of characteristics of habitat areas in subpopulation D to investigate the relationship of currently utilized habitat conditions to those outlined as Primary Constituent Elements documented in the revised critical habitat designation for the CSSS, November 6, 2007 (50 FR 62736).

On March 16, 2009, the Service provided the Corps with a copy of the draft FWCAR and solicited comments from the FWC and NOAA Fisheries as well as the NPS.

IX. EVALUATION OF THE PROJECT

A. Modbranch Model Benefit Evaluation Methodology

As discussed previously, one of the benefit evaluation methodologies used for evaluation of the C-111SC Project used calculations based on Modbranch model output designed to detect impacts within the study area associated with greater retention of water primarily in eastern ENP. The methodology applied identified and measured changes in timing of overland flow distributed to Taylor Slough as well as to hydroperiods and water depths and stages within the study area. Calculations were made comparing model output of project conditions to a desired condition for performance measures that resulted in an index of 0.0 to 1.0 (with 1.0 representing the ideal condition). Habitat units were then calculated for each performance measure by multiplying the index by the applicable acreage for the affected area for each performance measure. Net habitat units for each performance measure are expressed as the difference indicated by the proposed project to a future without project condition from Modbranch modeling (Table 5). Table 5 also displays the results for other alternatives (not selected for the proposed project) and project conditions (such as existing condition and future without project) that were also evaluated.

1. PM 1.5 Flow Timing and Distribution of Volume

The sheetflow timing and distribution performance measure is designed to characterize how much flow into Florida Bay from the Everglades is being concentrated in Taylor Slough and when during the year those discharges are occurring. The calculation was applied to a total area of 98,500 ac located in Little Maderia Bay, Northeast Florida Bay, and Taylor Slough. The results indicate that 4,117 habitat units are created by the proposed alternative spanning approximately 4 percent of the evaluation area.

2. PM 2.4 Stage Inferred Coastal Zone Salinities

The stage-inferred coastal zone salinity performance measure characterizes the yearly variation of salinity in coastal embayments as described by existing stage-based salinity regression equations provided by ENP. This performance measure was applied to an area of 27,300 ac located in Long Sound, Joe Bay, Little Madeira Bay, Manatee Bay, and Barnes Sound. The results indicate that 2,100 habitat units are lost by the proposed alternative representing approximately 8 percent of the evaluation area for this performance measure. This indicates that the proposed project (Alternative 2DShort) is having a net negative benefit based on the evaluation metrics for coastal zone salinity. A closer examination of Table 5 however illustrates that this effect is endemic to all alternatives evaluated, and may be a result of the more even redistribution of flows in the western project study area (a benefit), or due to the magnitude of anthropogenic complications and the large size and volume of Florida Bay and associated bays and sounds. Redistribution of flows into the western portion of the project study area has a resultant reduction of freshwater flows into Manatee Bay and Barnes Sound discharged through the S-197 and through the C-111 canal system. These areas are utilized by a wide variety of estuarine and marine species including the West Indian manatee. Reduction of large freshwater surge flows into these marine systems (and the resultant salinity extremes) will be a positive effect of the project. It will be important however, to assure that sufficient freshwater inflow is provided to meet the requirements of the endemic biota in these areas.

3. PM 2.1 Hydroperiod Inferred Vegetation Communities

The hydroperiod inferred vegetation communities performance measure characterized annual hydroperiods within defined indicator regions across the entire study area by describing what percent of each indicator region is experiencing a desired hydroperiod range indicative of desired conditions for the vegetative community. This performance measure was applied to an area of 155,110 acres representing the entire area of wetland landscape identified in Table 2. The results indicate that 3,761 habitat units are created by the proposed alternative representing approximately 2 percent of the evaluation area for this performance measure.

4. Aggregate Benefit Calculations

Individual evaluation measures were summed for each alternative and project condition and normalized to correct for double counting of affected areas by two or more of the individual performance measures. The results indicate that 5,779 total habitat units are created by this combination of the three performance measures utilized. Summing total acreage for all indicator regions yields a total of 252,400 ac (Table 2). Therefore, the aggregate habitat units would represent 2 percent of the total area evaluated.

These performance measures are only one component of the overall evaluation being performed for the project and were developed by the PDT to document the habitat units created (or lost) by the project with the proposed alternative relative to the expenditure of funds for the project. The PDT realized at an early stage in project planning that additional performance measures and criteria were needed to provide metrics capable of measuring project effects on the complexity of habitat types within the project study area. The Service evaluated the following performance measures and additional criteria for added insight into fish and wildlife effects and intends to expand this analysis in the Service's Biological Opinion for the project.

B. Project Performance Measures and Criteria

1. Taylor Slough Flow Volume

Based on the C-111SC Project goal to increase flow volume in Taylor Slough and delivery to Florida Bay the Service evaluated Modbranch model output of yearly total flow volume in acre-feet across transects bisecting Taylor Slough. Flow in Taylor Slough was examined for a series of transects distributed from north to south (Figures 26 and 27) for 1978 (average), 1989 (dry), and 1995 (wet). Present condition as shown by the Modbranch model run of without-project Initial Operating Regime (IORLO2), was compared to the with-project condition shown by the Modbranch model run of Initial Operating Regime for the recommended alternative 2DShort (IORLO2_2Ds). The flow results, in yearly total volume surface flow (acre-feet) across the transects, are presented for transects TSnorth; TSsouth; TA-1; TA-2; TA-1,2 Total; TB-1; TB-2; and TB-1,2 Total in Table 14. Also included in Table 14 are calculations of the change in flow volume between the Initial Operations Regime (IOR) and IOR with project (Δ), and the percentage change represented by the flow change in respect to the IOR flow (Δ percent IOR).

Transects TSnorth, TSsouth, TA-1 and TB-1 are oriented respectively from north to south across Taylor Slough (Figures 26 and 27) and in the 1978 (average) model output year, the respective percentage change (Δ percent IOR) increase for those transects is 82, 45, 30, and 12 percent. The 82 percent surface flow increase at TSnorth illustrates an initial sizable re-hydration benefit in the upper slough. The 1978 data indicates an overall loss in flows in average model years from the upper to the lower reaches of the slough. Examination of the same array of transect data during the 1995 (wet) model year indicates 528, 76, 53, and 39 percent increases in surface flow volume, respectively. The 1995 model output shows a similar loss of flows as in average years from the upper to the lower slough. The final amount of flow actually reaching Florida Bay cannot be determined as the model cannot account for the complications associated with tidal influences. No increase in flow volume across transects is indicated in the model output for 1989 (dry).

The combined flows across transects TA-1,2 Total and TB-1,2 Total oriented from north to south respectively (Figure 27), are an indication of the larger scale changes in project surface flows including areas to the east of Taylor Slough in the Model Lands. In the 1978 (average) model output year, the respective (Δ percent IOR) increase for those transects is 52 and 13 percent. The 52 percent surface flow increase at TSnorth illustrates a sizable initial benefit in the upper slough. The 1978 (average) data indicate a loss of these flows in the lower slough. Examination of the same array of transect data during the 1995 (wet) model year indicates a 108 and 36 percent increases in surface flow volume, respectively. However, the 1995 data indicates a similar trend in the loss of these "additional" flows as the water moves down the system. The final amount of flow reaching Florida Bay cannot be modeled due to the inability of the model to accommodate tidal fluctuations. No benefit in increased flow volume is indicated in the model output for 1989 (dry).

In summary, the previous analyses indicate that Taylor Slough should experience a substantial increase in flow that is transmitted downstream for a considerable distance and thus should provide benefits to wildlife associated with slough habitats. These increased flows dissipate as the water moves south toward Florida Bay. Therefore, flow benefits need to be further examined to disclose whether there are corresponding benefits to habitat and wildlife in the associated slough periphery and other habitat types (sawgrass, marl prairie, etc). Likewise, based on the dissipation of these flow increases, the benefits to the estuarine zones and Florida Bay are likely minimal.

2. Wading Bird Performance Criteria

Wading birds are a keystone wildlife guild that have experienced significant historical declines in southern Florida and the recovery of which are considered a key indicator of Everglades restoration. The Service analyzed the change in habitat units from the Modbranch model run of without-project (IORLO2) compared to the with-project condition, indicated by the Modbranch model run of Initial Operating Regime for the recommended alternative 2DShort, with-project (IORLO2_2Ds). Modbranch post processing was provided to the Service in weekly habitat unit calculations which were re-aggregated by month. Habitat units were calculated on the basis of each indicator region, integrating suitability indices for optimal foraging depth recession rates. The net monthly habitat units were further screened for just the 23 percent of acreage in a habitat area shown to be preferentially utilized by wading birds for foraging (Bancroft et al. 1995; Gawlik et al. 2004).

Table 10 illustrates wading bird habitat unit calculations summed for all indicator regions in the project study area by month and modeling year. Most effects indicated are small, in the range of -2 percent to +5 percent for all months and modeled years indicating that project effects on wading birds, either positive or negative, are being moderated over the landscape of the study area. There appears to be a negative overall trend in habitat units in November, December, and April, and a positive trend during the period from January to March. The exception to this trend occurs in December 1995, a wet year indicating a -20 percent effect of the project on wading bird habitat units.

Because a major project emphasis is on increasing flows to Taylor Slough, the acreage within Taylor Slough was also examined with this performance measure. Table 10 also illustrates wading bird habitat unit calculations analyzed for the Taylor Slough indicator region by month and modeling year. The effects indicated are again small, in the range of -1 percent to +4 percent for all months and modeled years, indicating that project effects on wading birds in Taylor Slough are small, based on this performance criteria. Again, there appears to be a positive trend from January to March, but in December 1995, the modeled wet year, data indicate a strongly negative (-62 percent) effect of the project on wading bird habitat units.

Indicator regions 3A and 3B (Tables 2 and 11) are the areas within which the majority of project features and direct effects are occurring aside from Taylor Slough. Results for indicator region 3A indicate that most project effects based on the wading bird habitat suitability criteria are negative, and range from a reduction of -2 percent to -77 percent habitat units. For this indicator region the most severe reductions in wading bird habitat units appear to occur in November to December (-15 percent to -77 percent) for both 1978 and 1995, respectively. Results for indicator region 3B show small effects on wading bird habitat except in the wet year (1995), which illustrates a variable effect ranging from -16 percent to +17 percent. Data for indicator region 3A showed no effect during the modeled dry year (1989).

The next largest indicator regions in the project study area are regions 3C and 3D (Table 11). The analysis for 3C indicates neutral or positive trends (+1 percent to + 13 percent) during 1978 and 1995 for the November through February time period, and for 3D, an increase of +8 percent in November 1978, and an increase of +23 percent to +33 percent in December and January. Data for indicator region 3D showed no effect during the modeled dry year (1989).

Tables 12 and 13 provide a visual synopsis of all wading bird performance criteria for every indicator region in the project study area. It is important to note that in this visual depiction each cell is the same size, while the indicator regions vary in size (Table 2) and biological importance. Both Tables 12 and 13 are arranged in the same matrix format that indicator regions are depicted in the top matrix of Table 2. For example, in Table 2 landscape type 2 (shrub dominated forested wetland) in zone A (439 ac) is in the top left corner of the matrix and constitutes the performance criteria for indicator region 2A. Similarly, landscape type 6 (coastal forest) in zone D (1,938 ac) is in the lower right corner of the matrix and constitutes the performance criteria for indicator region D6. In each matrix box, the cell directly under the cell labeled TS is performance criteria for the Taylor Slough indicator regions. Thus, the matrixes in Table 12 depict model output for three winter, dry-season months (November, December and January in columns) for average (first row), dry (middle row), and wet years (bottom row). Table 13 follows this format for February (winter) though April (spring). The color coding of the indicator regions provides a qualitative overview of the modeling output for the entire project area for 6 months during average, wet and dry years. Gray shaded cells indicate no change (based upon model output), while yellow to red indicate greater negative effects, and green to dark blue indicate increasing positive effects. For average (1978) model years, (the top row of Tables 12 and 13) the wading bird criteria are generally slightly positive, with notable negative effects in regions 3A and 6A during November and December. Positive effects are seen in regions 3C, 4D, and 2A during average years. During dry (1989) model years, (middle row of Tables 12 and 13) the wading bird criteria are largely neutral, with more slight negative effects predominating from November through January. In wet model years (1995) moderate to strong negative effects are seen during all months except January and April and some moderate positive effects are seen in all months except April. The variety of effects to wading bird performance criteria across various months and model years emphasizes the need for a well-crafted adaptive management plan with monitoring linked directly to management actions and direct assessment of meaningful indicators for wading birds.

3. Cape Sable Seaside Sparrow Performance Criteria

The CSSS is selective in its life history requirements preferring a short hydroperiod marl prairie habitat type that generally exists on the periphery, or within higher relief areas of more pronounced habitat features such as sloughs, marshes, and sawgrass flats. This very existence "on the edge" can create a condition where restoring more natural flow regimes (depth, timing, and duration) may affect short hydroperiods in sparrow habitat. This has necessitated an analysis of how to balance the wide range of wildlife species needs as part of overall restoration efforts. The rational and methodology for PMs used to evaluate effects on the CSSS were previously described in the methodology discussion in this report. Metrics were applied to Modbranch model output of scenarios comparing the initial operations scenario (IOR) to the initial operations with the proposed project (IOR_2Ds) and are subject to the important assumption that the model is accurately characterizing project conditions as they will actually occur on the ground. The complications involved in this assumption were previously discussed; nonetheless, model outputs can be used to evaluate the trends anticipated in comparing alternatives. In summary, the PMs analyzed included the following for CSSS and their designated critical habitat in subpopulations B, C, and D:

1. Habitat maintenance criteria for preferred nesting grass species included analysis of acreage experiencing a 60 to 180 day discontinuous hydroperiod (total number of days water level is above ground level) during the calendar year.
2. The area weighted average hydroperiod (days) in areas with a 60 to 180 day hydroperiod.
3. Nesting criteria that examined temporal and spatial characteristics during the nesting season including acreage exhibiting a maximum continuous dry period of more than 80 days (inclusive of two sparrow nesting and fledging cycles) during the period from March 1 to July 15.
4. The area weighted average continuous dry period (days) in areas with a >80 day dry period from March 1 to July 15.
5. Analysis of acreage and duration in critical habitat areas that had depth >20 cm during the period from March 15 to June 30.
6. Graphical analysis of habitat maintenance and nesting criteria to visually display project effects in the entire project study area.

Tables 6 through 8 and Figures 16 through 24 contain the results of these analyses.

a. Sparrow Nesting Criteria

The results of the nesting criteria analysis for subpopulations B and C indicate that few effects are expected to occur in the three representative modeled years (Tables 6 and 7). Whereas, data for subpopulation D indicate that 237 acres (2 percent of critical habitat) in the average (1978) year and 646 acres (6 percent of critical habitat) in the wet (1995) year will be affected by the project and no longer meet the >80 day continuous dry period criteria (Table 8). In addition, area weighted calculations of the average maximum continuous dry period in subpopulation D critical habitat indicate that the hydroperiod range will exceed the >80 day criteria, as they currently do without the project. Furthermore, modeling shows that this metric will continue to exceed 100 days in all modeled years (Table 8).

Although the analyses above indicate minimal changes from current without-project (IORLO2) conditions, these effects on nesting criteria need to be considered along with other parameters. The area weighted calculations of average maximum continuous dry period for subpopulation B illustrate that in an average year (1978) without-project (IORLO2) condition, this subpopulation averages 85 days and in a wet year (1995) it averages 52 days of continuous dry days compared to the same data in subpopulation D, which averages 119 to 128 days (1978) in an average year and 100 to 112 days in a wet year (1995). Sparrow subpopulation B has been documented to support the largest most self-sustaining subpopulation over the recent past, whereas subpopulation D has struggled to persist (Table 4). This comparison may indicate other factors are contributing to the overall habitat suitability or nesting success in subpopulation B.

Calculated metrics for areas with depths >20 cm from March 15 to June 30 showed that the modeled effects of the project are small (<1 percent of total acreage in all subpopulations). In subpopulation B, data indicate that this metric was exceeded in 12,454 acres (32 percent of critical habitat) for more than 1 day and in 1,869 acres (5 percent of critical habitat) for more than 30 days, supporting the previous observation that further investigation of habitat relationships in subpopulation B are warranted.

In summary, no appreciable effects on subpopulations B and C are anticipated and only minimal effects on subpopulation D are indicated based on the nesting criteria metrics analyzed with Modbranch data.

b. Sparrow Habitat Criteria

The most revealing analysis from the Modbranch output data was the habitat maintenance criteria for preferred nesting grass species that included analysis of acreage experiencing a 60 to 180 day discontinuous hydroperiod during the calendar year (total number of days water level is above ground level). The analysis performed for subpopulation B critical habitat indicated that the proposed project would have no apparent effect based on the metric. The analysis also showed for subpopulation B critical habitat that this hydroperiod range occurred on 25,169 acres (64 percent of total acreage in critical habitat) in both the with and without-project scenarios during average years. The same metric showed that for the dry year (1989) 2,304 acres (6 percent) and for the wet year (1995) 313 acres (1 percent) met the hydroperiod range for discontinuous hydroperiod (Table 6).

Table 7 details the Modbranch analysis for the habitat criteria based on the discontinuous hydroperiod metric (60d < HP < 180d) for sparrow subpopulation C critical habitat. Table 7 shows that the project may benefit critical habitat in subpopulation C during an average (1978) model year, as 1,442 acres in this habitat will experience a 60 to 180 day discontinuous hydroperiod. This represents a 17 percent increase in total available habitat and a 45 percent increase compared to the acres of critical habitat meeting the metric in the without-project scenario. The area weighted average hydroperiod metric shows a net increase of 3 days from 95 to 98 days with the project. The model output for this subpopulation in the dry (1989) year analysis indicates no apparent effect of the project. Whereas, data for the wet (1995) year reveals that the project will have an adverse effect on the discontinuous hydroperiod that maintains sparrow habitat.

A total of 1,320 ac in subpopulation C which experiences a 60 to 180 day discontinuous hydroperiod in a wet year, represents a 16 percent decrease in total available habitat over current conditions and a 23 percent decrease compared to the without-project scenario. It is interesting to note that more habitat meets the 60 to 180 day criteria in a wet year (1995) than an average year (5,771 ac and 3,240 ac, respectively) in the without-project scenarios (Table 7). The with-project scenarios indicate that 4,451 ac will meet the hydroperiod criteria in a wet year (1995) and 4,682 ac in an average year (1978). This indicates that the project may provide net overall habitat benefits, even in a wet year for subpopulation C. The area weighted average hydroperiod (days) shows a net increase of 15 days from 135 to 150 days with the project in a wet year (1995).

The modeling output for subpopulation D indicates a more problematic relationship, especially for the acreage of critical habitat meeting a 60 to 180 day discontinuous hydroperiod metric (Table 8). The without-project output indicate that part of this subpopulation is currently impacted by increased hydroperiod which can cause the conversion of shorter hydroperiod preferred habitat to longer hydroperiod sawgrass. Subpopulation D is located in an area adjacent to proposed project features that may potentially result in marked water stage and duration increases (Figures 16 to 24). This metric reveals that the project may be detrimental to sparrow habitat in subpopulation D during an average (1978) year. A potential reduction of 1,606 ac of subpopulation D critical habitat represents a 15 percent decrease in total available habitat compared to current conditions and an 18 percent decrease compared with the without-project scenario. The area weighted average hydroperiod (days) shows a net increase of 29 days from 124 to 153 days with the project which also indicates a potential reduction of suitable habitat within the designated critical habitat. The data for subpopulation D in the dry (1989) year analysis indicates no apparent effect of the project.

Data for the wet (1995) year reveals that the project may negatively affect subpopulation D. A reduction of 1,421 acres of suitable habitat may occur in the acreage experiencing a 60 to 180 day discontinuous hydroperiod in a wet year, representing a 13 percent decrease in total available habitat compared to current conditions and a 39 percent decrease compared with the without-project scenario. The area weighted average hydroperiod (days) for the wet (1995) year shows a net decrease of 17 days from 154 to 137 days with the project. This decrease is due to the increased acreage in habitat which exceeds the 180 day criteria, leaving a reduced amount of acreage in the hydroperiod window.

Table 9 provides an additional analysis of the 60 to 180 day discontinuous hydroperiod during an average model year (1978) for subpopulation D. This table displays the without project and with-project hydroperiod, in average number of days, separated by incremental ground surface elevations within the habitat boundary. The acreages within each incremental elevation zone are also shown. For all subpopulation D critical habitat acreage (10,806 ac) tabulated in Table 9, 10,341 ac or 96 percent of the total, fall within the 60 to 180 day hydroperiod window in the without-project scenario, but only 6,647 ac or 62 percent will meet this window in the with-project scenario. Table 9 also illustrates a shift in 4,159 acres above the 180 day criteria with the project for habitat below 2.4 ft NGVD29 elevation. The 2.4 ft elevation zone represents the "trigger cell" location elevation in subpopulation D that will be used to limit project operation stage changes and minimize effects on the Cape Sable seaside sparrow. Finally, 1,802 ac that in the without-project scenario were below the 60 day hydroperiod criteria now fall within the 60 to 180 day window indicating an incremental benefit. However, during an average year, the model output indicates a potential reduction of 4,159 ac of suitable habitat which would be offset slightly by the potential gain of 1,802 ac of habitat for a net potential loss of 2,357 ac (22 percent) of habitat in subpopulation D.

c. Cape Sable Seaside Sparrow Spatial Analysis

The previous analyses and discussion of project effects on CSSS habitat illustrates the complexity involved in assessing the project effects on individual subpopulations and evaluating the overall effects of the project on a landscape scale. The Service reiterates that the previous analyses were conducted based on model output and subject to concerns expressed with modeling in other sections of this document. Calculations of acreages affected in individual sparrow critical habitat units using various metrics provide insight into the volume of perceived effects but do not reveal the spatial distribution of those effects both within the critical habitat units and within the project study area as a whole. The previous analyses illustrated that project effects are principally related to the 60 to 180 day discontinuous hydroperiod. The Service conducted additional analyses using Graphical Information System (GIS) software to illustrate the spatial relationships of this metric. Figures 16 through 18 display this data for the average (1978) year, Figures 19 through 21 for the dry (1989) year, and Figures 22 through 24 for the wet (1995) year. Three illustrations are provided for each year modeled to depict the spatial extent of hydroperiod ranges from 0 to 365 days throughout the project study area for the IOR without-project, the IOR with-project, and a "difference map" showing positive or negative project changes in hydroperiod. The difference map represents the change in conditions based on model output attributable to the project.

For CSSS subpopulation B, the spatial analysis revealed no discernable effects of the proposed project on habitat suitability for any of the years modeled. In addition, no detectable project effects were evident from the spatial illustrations generated for the dry year (1989) in any sparrow critical habitat or in the project study area (Figures 19-21). The following discussion will therefore be focused on the graphical representations for the average (1978) year (Figures 16-18) and the wet (1995) year (Figures 22-24) for the 60 to 180 day discontinuous hydroperiods.

Figures 18 and 24 illustrate the differences in hydroperiod days between the without-project and with-project simulations in average and wet years as modeled. As illustrated in the key provided, areas shaded in progressively darker shades of blue will experience increasingly longer discontinuous hydroperiods as a result of the project. Likewise, the areas shaded in progressively darker shades of brown will experience increasingly shorter discontinuous hydroperiods as a result of the project. Evident in both figures is the change in the area bordering the C-111 and L-31W canals in immediate proximity to project features. The results of modeling for these areas indicates that discontinuous hydroperiod will increase based on the proposed project by 20 to 138 days. An important aspect of the location of these increases is their occurrence within designated critical habitat for CSSS subpopulations C and D. Also illustrated (and detailed in the figure keys) are the locations of annual survey points for sparrows and a comparative indication of detection frequency (size of dot) as a relative indication of sparrow habitat preference within the critical habitat. A comparison of the hydroperiod increases and areas used by sparrows within critical habitat, indicate that negative effects on sparrow habitat could result in conversion of habitat to plant species not preferred by sparrows in some areas.

Depictions of the indicated hydroperiod difference created by the proposed project are useful in initially screening for areas of change from the without-project condition, but need to be interpreted with full knowledge of the initial hydroperiod indicated by the model that may occur in the area, and the modeled hydroperiod conditions expected with the proposed project. Some areas within the project study area may not currently be experiencing the optimal hydroperiod for the desired habitat type and may benefit from indicated changes. Concurrently, some areas may have the desired hydroperiod that could be negatively affected from indicated changes. Figures 16 and 17 illustrate the indicated average year discontinuous hydroperiod (0 to 365 days) in the entire project study area for the IOR without project and the IOR with project model output and Figures 22 and 23 illustrate the same for wet year information.

These figures reveal a multitude of potential project effects and permit a more detailed investigation of the effects indicated by the model output and outlined by the previously discussed difference maps. Following is a list of some notable potential project effects.

1. Comparison of Figures 16 and 17 indicates that in an average year, subpopulation C critical habitat will experience an increase in acreage exhibiting the desired 60-180 day discontinuous hydroperiod (indicated by green shading) in the southern portion of the habitat that exhibits moderate sparrow use. This appears to be the result of currently dryer habitat moving into the desired hydroperiod window. However, in a wet year, this same area appears to be too wet in the with-project condition in a comparison of model output in Figures 22 and 23.

2. Comparison of Figures 16 and 17 indicates that in an average year, subpopulation D critical habitat will experience a decrease (indicated by the expansion of blue shaded area) in acreage exhibiting the desired 60-180 day discontinuous hydroperiod (indicated by green shading), primarily in the southeastern portion of the habitat. This portion of the critical habitat has recently exhibited limited use by sparrows. A northern segment of subpopulation D habitat along the C-111 canal that is indicated in the without project condition to be too dry will be within the desired hydroperiod window in the with-project condition based on model output; potentially benefiting this area.
3. Comparison of Figures 22 and 23 indicates that in an wet year, almost all of subpopulation D critical habitat west of the C-111 canal will have a hydroperiod exceeding the desired 60-180 day discontinuous hydroperiod (indicated by the expansion of blue shaded area) in the with-project scenario.

4. Comparison of Figures 16 and 17 indicates that in an average year, there is the potential for CSSS habitat to expand in the project study area outside of the current subpopulation D critical habitat area to the north and east. This is based on the modeled occurrence of the desired 60-180 day hydroperiod and needs to be further evaluated for other habitat characteristics needed by the sparrow. A comparison of model output of a wet year (Figures 22 and 23) indicates that the with-project condition also appears to allow for additional potential habitat in this area to be created.

In summary, Figures 16 and 17 provide an overall view of the discontinuous hydroperiod that will occur throughout the project study area as indicated by the model. Areas depicted in various shades of green fall within the 60-180 day hydroperiod window that is optimal for maintenance of sparrow habitat. Decreases in available habitat due to the with-project condition appear to be concentrated within critical habitat for sparrow subpopulation D in modeled average and wet years. Other areas are indicated by the model with-project condition, both within and outside critical habitat for sparrow subpopulations C and D in average and wet years that may be within the desired hydroperiod window and therefore could be beneficial to expansion of sparrow habitat.

d. Wading Bird Spatial Analysis

Diversion of water to Taylor Slough in the IOR with-project condition, that currently is routed down the lower C-111 canal between S-18C and S-197, and allowed to overflow the southern levee that has been degraded, will result in a notable shortening of hydroperiod in the surrounding area that encompasses the "panhandle" segment of southeastern ENP. Comparison of Figures 16, 17, and 18 in an average year and Figures 22, 23, and 24 in a wet year illustrate this changed condition based on the model output. The area is evident in Figures 18 and 24 as a variously shaded brown area encompassing the lower C-111 (between S-18C and S-197) and C-110 canals that is experiencing decreased hydroperiod (-20 to -92 days in the average year and -20 to -199 days in the wet year). This area of decrease appears linked to operations prioritizing water delivery to Taylor Slough instead of allowing it to flow through the C-111 and C-110 canals in this area. This area has been documented as important foraging habitat for a variety of wading birds including the roseate spoonbill (Bancroft et al. 1995; Bjork and Powell 1994; Lorenz 2000; Lorenz et al. 2002). A change of the magnitude indicated by the model output could be detrimental to prey productivity and wading bird foraging in this area.

One final area of note is the graphical depiction of project changes during the wet year in Figure 24. This area encompasses the L-31E canal and appears to be an effect of project features related to stage changes and a plug on this canal. A 20 to 60 day increase in hydroperiod is indicated by model output in the Model Lands Basin and could be beneficial to wading birds.

X. RECOMMENDATIONS/CONSERVATION MEASURES

A. Altered Hydrology and Operations

The Service recommends that the Corps and District review proposed project operations to assess their effects to the productivity of wading bird habitat that model output indicates will have a reduced hydroperiod in the ENP panhandle area, south of the C-111 canal between S-18C and S-197. Sufficient water depth and duration is needed for prey production prior to initiation of nesting. Once wading bird nests are initiated, water depth and recession rate needs to be optimized to make prey available for foraging.

A review of proposed project operations in the C-111 canal that affect discharge through the S-197 should also be conducted. While elimination of excessive flows through this structure and moderation of salinity fluctuations was a project goal, there remains a need to provide an adequate base flow level for maintenance of a natural salinity regime in Manatee Bay and Barnes Sound and should be considered during implementation of Phase 1 and planning for Phase 2.

The Service recommends monitoring the effects of the installation of the ten C-110 canal plugs. This monitoring should include intensified monitoring of stage and flow gradient before and following construction to determine if the hydrological characteristics have changed due to the plugs. If data indicate that the drainage effect of the canal on surrounding marshlands has not been sufficiently reduced, then an evaluation of the feasibility of a complete canal backfill should be conducted.

A wide variety of barriers to both surface and groundwater flow such as roads, ditches, canals, levees, building pads, and rock pits, will still exist in the C-111SC Project study area after Phase 1 project construction. Hydrologic monitoring as part of post construction monitoring should be conducted with consideration of how these features may be affecting project success and how modification or removal of these structures may facilitate successful implementation of Phase 2.

The Service recommends that the Corps evaluate the impingement and entrainment of fishes and other aquatic organisms at all project inflow pumps as a pilot project to estimate the significance of cumulative impacts on native fishes, and recreational and commercial fisheries, for all the pumps in the C-111SC selected plan. The pilot project should evaluate intake designs, screens, and pump type (*e.g.*, screw-type pumps should injure or kill fewer fish than impeller-type pumps). Furthermore, the Service recommends that any new pumps that are installed prior to the end of the pilot project have the capability to be retrofitted with devices (such as screens) that will reduce or eliminate impingement and entrainment of fish and other aquatic life.

B. Water Quality

The water quality of the C-111E canal has the potential for disrupting the ecology of marsh areas that may be receiving inflows. Contaminants detected by past monitoring studies of the C-111E canal include metals (*e.g.*, lead, chromium, cadmium, zinc, and copper) and pesticides (*e.g.*, atrazine, endosulfan, and DDT) (Carriger et al. 2006; Carriger and Rand 2008a, 2008b). Pumping operations that are part of the C-111SC Design Test Project (proposed to test spreader canal feasibility on a small scale) and future full scale spreader canal implementation in Phase 2 could result in this impaired water quality potentially entering surrounding marshes. The Service recommends that planning for the C-111SC Water Quality Pilot Project (proposed to test feasibility of water quality treatment technologies) be resumed and the proposed project implemented after a full analysis of feasibility.

The Service recommends that the Corps, District and the C-111SC PDT work collaboratively to develop a water quality monitoring plan and sampling points for both surface and groundwater that may include new well points or monitoring locations at areas of concern (such as the FPDA feature, Aerojet Canal feature, C-111 Design Test project, and C-111SC Phase 2 proposed full scale spreader canal potential corridor) to adequately assess environmental risk. If contaminants are found during project monitoring at levels that exceed those established by the U.S. Environmental Protection Agency (EPA) to protect aquatic life (EPA 2002), the Corps should modify project operations and monitoring accordingly and coordinate with the Service and other stakeholders.

C. Contaminants

Detected levels of copper in the original Ecological Risk Assessment and the Additional Soil Investigation in the proposed FPDA prepared by Newfields and URS Corporation for the District presented a concern for Service trust resources, including the endangered Everglade snail kite. Whereas detected concentrations of other metals and pesticides compared to the original Ecological Risk Assessment were noticeably lower in the Additional Soil Investigation conducted within the project footprint due to a change in the footprint. The maximum observed concentration of endosulfan (66.3 μg/kg) predicted no risk to avian fauna using a food-web model (hazard quotients <0); however, impacts to the aquatic community and fish are still possible. The Service concurred with the District recommendation for soil scraping and use of this soil for construction of berms capped with clean soil. This concurrence is provided post-scraping confirmatory sampling is conducted on a representative percentage of the project site and levels of metals and pesticides are sufficiently low, based on an Ecological Risk Assessment, to pose a minimal hazard to wildlife. The confirmatory sampling should include a measure of the relative percent of soil remaining within the scraped footprint and the concentration of copper, other metals, and pesticides within these soils. Additional detail on the Service position is provided in Appendix F.

To date, Modbranch modeling indicates that in an average year up to 90 ac of the FPDA could be inundated for 80 days or longer at an average depth of 1 ft. These conditions could sustain a short hydroperiod wetland vegetation community and its associated fauna, which have the potential for contaminant uptake and bioaccumulation. In addition, drying conditions that concentrate any prey entrained in pumped flows from the C-111 canal may attract foraging migratory bird species. To prevent potential contaminant exposure to fish and wildlife resources, corrective actions may be necessary. Once soil sampling is complete for the entire FPDA, the Service can issue recommendations on the necessity of specific corrective actions and monitoring.

D. Migratory Birds

The C-111SC project study area encompasses a wide variety of habitats including wooded, marsh, estuarine, and shoreline habitats that are extremely important as habitat for migratory birds. Maintaining these sites as high-quality habitat for migratory birds is important and the final project design, construction and operation need to be accomplished with full consideration to conservation of viable migratory bird habitat.

Lucky Hammock, located beside Aerojet Road, is an important "jumping off" site for migratory birds in the Atlantic Flyway, benefiting both migratory birds and bird watchers. This area is part of the Great Florida Birding Trail and implementation of the proposed Aerojet Canal component of the C-111SC Project should preserve both the integrity of this habitat and access for birders. Final project design, construction, and operation should be accomplished so that this area is not negatively impacted by changes in hydrology, displaced by project components, or disturbed by construction activities.

E. Hydrologic Modeling Issues

Use of the Modbranch model during project planning to simulate hydrology in the project study area for three representative years weakened our ability to analyze to the detail that could have provided scrutiny of each individual year over a period of record and the statistical power inherent in examination of a population of years. As project construction and operation proceeds, the effects of climatic and associated hydrologic variation within the annual cycle need to be further scrutinized and adjusted for in operations to maximize project benefits and minimize adverse effects to project study area habitat and wildlife.

Discrepancies between the base ground surface elevation coded into the Modbranch model and known ground-truthed locations within the project study area need to be further investigated and corrections made as part of project implementation. In some cases these comparative elevations may have differed by up to 1 foot. These differences could appreciably change modeled project effects.

F. Monitoring and Adaptive Management Plans

Given the uncertainties related to modeling and effects of the proposed project implementation, the development of sound monitoring and adaptive management plans is vital to the success of this project. The Service recommends close adherence to the water quality and ecological monitoring plans established for the C-111SC Project, including the ecological monitoring specified in the RECOVER Monitoring and Assessment Plan and the project-level monitoring plans appearing in the PIR. This monitoring should be periodically evaluated for relevance and usefulness. Also, the Service recommends that an adaptive management plan be developed for the project and implemented to maximize the restoration success of the project and to provide information for the planning and construction of Phase 2 of the project. This adaptive management plan should also be periodically reviewed and revised as appropriate. This process should facilitate the restoration and enhancement of the C-111SC Project's wetland and estuarine habitats.

G. Integrating the Project with Comprehensive Restoration Efforts

As other features of the CERP are designed and operated, water management protocols for C-111SC Project components need to be reconsidered in the context of the modified C&SF Project. This may include provisions for a future increase in water availability, storage capacity and treatment, and modification of operations for elements of the selected plan to benefit Florida Bay, its coastal wetlands, and the Southern Glades, that are consistent with the C-111SC Phase 1 and Phase 2 goals and objectives.

H. Protection and Recovery Measures for Listed Species

Some of the proposed construction sites and effects will occur on public or private properties for which we have limited information regarding the presence of federally listed species. Therefore, as those sites are accessed or acquired (or easements are negotiated), the Corps should ensure that more detailed surveys are conducted by qualified biologists to determine the presence of listed species. If listed species are found, the Corps and Service will determine if re-initiation of consultation in accordance with section 7 of the Act is necessary.

The Service is concerned about the potential for the exposure of federally listed species, as well as other fish and wildlife, to contaminants when former agricultural lands are flooded. If the ecological risk from contaminants to listed species becomes evident, the Corps and Service will determine if re-initiation of consultation in accordance with section 7 of the Act is necessary.

The Corps should notify the Service's South Florida Ecological Services Office no later than 1 month prior to start of the construction phase for any of the components so that we may, if available, observe construction activities and monitor effects, if any, of construction activities on threatened and endangered species.

Should blasting be necessary, the Corps should follow the Service's "Guidelines for the Protection of Marine Animals During the Use of Explosives In the Waters of the State of Florida" (Service 2006b), and monitor wildlife activity in the construction area during this action. Care should be taken to avoid unnecessary disturbance of roosting, foraging, or wading birds or other local wildlife such as perching birds, raptors, waterfowl, mammals, reptiles, amphibians, and fish that utilize associated habitats. A qualified fish and wildlife biologist should be present throughout blasting activities to monitor fish and wildlife response and offer advice to construction personnel.

The Service recommends adding wildlife corridors beneath or through roadways, particularly Card Sound Road, to reduce crocodile mortality caused by motorized vehicles. Mortality from automobiles account for a large number of crocodile deaths in south Florida, and it is particularly a problem along Card Sound Road, which is in the project area. The Service recognizes that this recommendation falls outside the spatial scope for the Tentatively Selected Plan, but these corridors should be given a high priority for Phase 2 of the C-111SC Project.

For additional species listed as threatened, endangered, or of special concern by the State of Florida, the Corps should consult with the FWC regarding those species' habitat needs and additional recommendations to conserve those species.

Florida Panthers

The C-111SC study area is within the designated Primary Zone of the Panther Focus Area for the Florida panther (Service 2006a) and the project construction area footprint will be contained within this zone. The habitat value for Florida panther within the project study area is considered to be moderate with occasional dispersal activity from the panther core population farther west in ENP and Big Cypress National Preserve. Recent mortalities from vehicle collisions have occurred. Any panthers inhabiting the study area habitat could be impacted by noise from construction activities. Preliminary construction planning information provided by the District indicated that based on anticipated equipment and vehicle access needs there could be a considerable increase in vehicle and equipment traffic accessing the project sites on levees, the FPDA site, and throughout the study area where construction will occur. These increases cannot be quantified until final construction plans have been completed. Precautions should be taken to avoid potential collisions with panthers including speed restrictions and limiting construction activities to daylight hours when any panthers present would be less active.

West Indian Manatee

The L-31N and C-111 canals are accessible to West Indian manatees. These canals should be surveyed in the project study area by qualified observers to monitor manatee presence prior to construction as well as during project construction. Any new canals that are constructed as part of this project that are hydraulically connected to Florida Bay (or any other water bodies inhabited by, or capable of being inhabited by, manatees) must have barriers to prohibit manatee movement into newly constructed canal reaches from the bay (or other relevant water bodies inhabited by manatees). This includes the proposed C-111SC Design Test canal associated with this project. Such barriers will ensure that C-111SC Project facilities will pose no additional threat of structure-caused mortality or injury, entrapment in culverts or canals, or any other form of take, as defined in the Act and Marine Mammal Protection Act. Manatee barriers should be provided for all new pump stations, culverts, and other structures as appropriate.

Everglade Snail Kite

None of the project study area impacts critical habitat designated for the Everglades snail kite. The presence of foraging and nesting snail kites is possible in the project study area and project construction site as well as access and staging corridors. If possible, construction should be planned outside the potential nesting season (December 1 to July 31). Regardless, surveys should be conducted prior to and during construction according to Snail Kite Survey Protocol (Appendix B), in addition to accessing all additional data from resource managers and researchers on presently documented locations of foraging areas, snail kite nest sites, and kite protection buffers. Draft Snail Kite Management Guidelines (Appendix C) for protection buffers and management areas should be followed.

Construction activities and equipment operation associated with the project could create noise levels that could be disturbing to kites and other wildlife depending on the decibel level and distance needed to attenuate those noise levels. Data is available on typical construction noise levels and its effects on wildlife (Cowan 1993; U.S. Department of Energy 2001; Imperial Oil Resources Ventures Limited 2005; Knauer 2006). These and other studies have documented various disturbance effects such as nest relocation, interrupted brooding, and flushing on avian wildlife at noise ranges above 40 decibels (dBA). Noise levels should be monitored during construction and precautions and restrictions implemented if disturbance is indicated to monitored nesting and foraging sites.

Wood Stork

The wood stork may forage in marshes and canals within and adjacent to the C-111SC Project site and project study area. The Service recommends that the project sponsors adhere to the guidelines found in Habitat Management Guidelines for the Wood Stork in the Southeast Region for construction-related actions (Ogden 1990) (Appendix D). Specifically, there should be no disturbance to feeding sites when storks are present. This would include guidelines for noise disturbance discussed above for Everglade snail kite. Construction related activity should be no closer than 300 ft when a solid vegetation screen is present and no closer than 750 ft when there is no vegetation screen (Ogden 1990).

Cape Sable Seaside Sparrow

Prior to initiating project operations, further analysis of project effects on hydrologic conditions in CSSS critical habitat areas in subpopulations C and D should be conducted to facilitate preparation of operational flexibilities that consider sparrows and other species and habitat to maximize overall project benefits. These operations could be related to specific trigger cells located at key locations at verified ground elevations. An operations schedule should be developed with consideration of project structure operations during time periods key to sparrow life history requirements.

Monitoring of hydroperiod, water depth and vegetative community composition needs to be an integral part of the baseline and post construction and operation ecological monitoring plan not only in sparrow habitat areas, but all areas of the project study area affected by hydrological changes.

Current survey data for occurrence of CSSS is providing valuable information and needs to be continued. This includes helicopter surveys being conducted by NPS along the existing grid network in all subpopulations, but specifically in subpopulations B, C, and D in the project study area.

Vegetation surveys similar to those conducted by FIU (Ross et al. 2003) should also be continued. These surveys include transects that include observations of vegetation, periphyton, soils, and topography. Figure 29 illustrates the location of the current vegetation transect being sampled in subpopulation D. Due to the anticipated changes of the project indicated by model output, the survey transects for vegetation surveys in subpopulation D should be expanded to increase coverage in areas that will be impacted by hydroperiod changes as well as to better monitor areas currently being used by CSSS. Figure 29 also illustrates the additional transect locations that are recommended in subpopulation D. These additional transects should be surveyed annually.

Due to the anticipated changes indicated by model output for the project, vegetation surveys should be expanded to areas outside the critical habitat that model output indicates will be affected by hydroperiod changes potentially beneficial to sparrows, in addition to monitoring areas that may currently be utilized by CSSS. These surveys should include transects that include observations of vegetation, periphyton, soils, and topography.

The U.S. Geological Survey, EVER4 water level gauging station is centrally located in subpopulation D critical habitat and can continue to be used for monitoring purposes. Historical data provided by the gage compared to Modbranch model output does not indicate a reliable and consistent association. Examination of field conditions and ground elevation at the gage compared to other habitat areas in subpopulation D suggests that additional monitoring points are needed to sufficiently characterize and monitor habitat conditions needed by the CSSS in subpopulation D. Additional water level gauging stations should be established with daily output of stage to be used to better establish the relationship with the existing EVER4 station as well as for adaptively managing and calibrating project operations to minimize effects on CSSS. Figure 30 shows the recommended locations for these additional water level gauging stations.

Critical habitat in the project study area should have extensive ground elevation surveys performed to facilitate a better understanding of sparrow habitat conditions and project operations as well as enhancing the ability to protect important sparrow habitat.

Ground tracking and banding surveys that have been conducted for sparrows in the project study area (Lockwood et al. 2006) should be continued for critical habitat within the project study area and possibly expanded to areas that model output indicates could exhibit hydrologic conditions conducive to the sparrow.

The Corps and District should prepare and implement a Cape Sable seaside sparrow management plan for the C-111SC Project study area in consultation with the Service that would include identification of potential sparrow habitat expansion both within and outside of designated critical habitat areas, recommended management and monitoring, and other possible habitat enhancement measures both within critical habitat and in potential expansion areas. The management plan would include measures such as woody vegetation removal, fire management, and creation of sawgrass refugia.

Eastern Indigo Snake

The eastern indigo snake may be present in and around the construction area for this project. The Corps should comply with the Standard Protection Measures created for the eastern indigo snake (Appendix E). Standard Protection Measures include the development and implementation of an eastern indigo snake protection and education plan for all construction personnel to follow. This plan should be submitted to the Service for review and approval at least 30 days prior to the commencement of any construction activity. Informational signs should also be posted throughout the construction site and along any proposed access roads to alert construction personnel to the likely presence of this species. These signs should contain a description of the snake, its habits and protection under Federal law; instruction not to injure, harm, harass or kill this species; directions to cease activity to allow the snake sufficient time to move away from the activity; and telephone numbers of pertinent agencies to be contacted if a dead snake is encountered. If a dead snake is found, it should be covered in water and then frozen. In addition to the protection and education plan, an eastern indigo snake monitoring program should be submitted to the Service's South Florida Ecological Services Office in Vero Beach within 60 days of the conclusion of construction activities. This report should be submitted whether or not eastern indigo snakes are encountered.

American Crocodile

Because of the possibility of crocodiles nesting or being present in the project area, and because vehicular traffic will temporarily increase during project construction, which may affect crocodiles if they are present, pre-construction crocodile surveys are requested for this project. At this time, the Service has no formal written guidelines to reduce construction-relate effects on crocodiles. However, if crocodile nesting is observed, the Service will work with the Corps and District to outline reasonable measures to avoid disturbing or injuring crocodiles.

Other Wildlife Species

Prior to and during construction activities, the project site should be surveyed for the occurrence of State listed species of special concern such as the burrowing owl and gopher tortoise, which could potentially be found on canal banks and road berms. If state listed species are found, protective measures should be taken as directed by FWC. Similar surveying and protection protocol should be implemented for wading birds, such as the roseate spoonbill, little blue heron, snowy egret, tricolored heron, white ibis, Florida sandhill crane, and limpkin in feeding and nesting areas that may be disturbed within and adjacent to the C-111SC Project site and project study area.

The removal and control of invasive non-native plant species is important to the success of this project. The Service recommends that sufficient project assets be provided for the initial physical or chemical removal of non-native vegetation. Changes in hydrology resulting from the project should contribute substantially to the control of non-native vegetation, but initial removal

of mature stands will be required. Removal and control of invasive non-native vegetation also influences the survival and well-being of the listed plant species in the project area.
The Service recommends that an invasive non-native species management plan be implemented as part of the Tentatively Selected Plan. This management plan should have four components: (1) construction practices that reduce the spread of the non-native plants; (2) initial aggressive treatment and management of substrates that are bared by restoration activities; (3) monitoring of non-native vegetation, and (4) extensive site management activities by the land manager, including controlled burns. Without such a plan, invasive non-native vegetation would re-infest the project area, particularly the construction areas, reducing the benefits of the action.

XI. SUMMARY OF POSITION

The Service recognizes that a substantial effort has been expended, often under demanding time constraints, and the PDT has made considerable adjustments from the project as originally conceived. The recommended plan embodies a satisfactory foundation for what we view as a multi-stage project implementation that, following the formulation of final design and construction, should include incremental implementation of operations, monitoring, and adaptive management to achieve maximum benefits to species and habitats; and an iterative process feeding into planning and implementation of Phase 2 for this project. The Service supports proceeding with the proposed project based on the planning documented to date in the draft PIR subject to any changes that may occur in the final PIR. It is expected that the recommended project plan, as described, should provide hydrologic and ecologic improvements to the marshlands of Taylor Slough, the Southern Glades, Model Lands, and ENP. The proposed project should provide progress towards implementing an adaptive process that will facilitate better management and understanding of hydrologic influences and salinity relationships in nearshore waters of Florida Bay, and Barnes and Card Sounds and the adjacent coastal wetlands. Estuarine resources in the project area should be positively affected by the restoration of a more natural freshwater flow regime feeding the nearshore zone. However, the re-establishment of the salinity regime to realize a complete restoration of fish and wildlife resources throughout the nearshore zone in the project area will require more freshwater than is currently available, particularly during the dry season. Although estuarine ecosystems are designed to withstand seasonal variation in salinity, the pulsing or inundation by freshwater or, alternately, the elimination of variability because of the reduction of freshwater input are harmful to the health of the system. Reduction of point source discharges at major conveyance canals as a result of implementing the C-111SC Project will reduce the unnaturally large fluctuations in salinity near canal mouths, resulting in more stable salinity regimes in these areas, which should improve habitat for fish and invertebrates inhabiting the areas near the canal outlets.

At the landscape level, completion of the C-111SC Project is important to the management and improvement of resource values of the adjacent conservation areas with Federal interest, such as ENP, Biscayne National Park, the Florida Keys National Marine Sanctuary, and Crocodile Lake National Wildlife Refuge. In addition to contributing to improving a wide ranging regional landscape for wildlife, the restoration area will conserve infiltration areas to benefit groundwater resources, effecting base flow to sloughs, other flow ways, marshlands, estuarine and bay areas and help to maintain barriers to salt-water intrusion.

Recovery of federally threatened and endangered species would generally be fostered by improved habitat conditions in the project area that are initially indicated by model output. Federally listed species in the project area include, but are not limited to, the Florida panther, West Indian manatee, Everglade snail kite, wood stork, CSSS, roseate tern, sea turtles, American crocodile, eastern indigo snake, smalltooth sawfish, Schaus swallowtail butterfly, crenulated lead-plant, tiny polygala, and Garber's spurge. Throughout the planning for this project, the District and Corps have been in informal consultation with the Service and have requested formal consultation as of April 22, 2009, under the Act. Implementation of the project should benefit several federally listed species by improving freshwater flow to a variety of habitat types that will result in corresponding beneficial responses throughout the ecosystem. Estuarine resources in the project area should be positively affected by the restoration of a more natural freshwater flow regime feeding the nearshore zone. However, there will likely be some short-term and small-scale negative impacts to listed species, such as disruption of local feeding areas due to project construction activities and habitat for the Cape Sable seaside sparrow that may experience extended hydroperiods exceeding its optimal range. The West Indian manatee may experience periodic localized reduction in freshwater flow in the C-111 canal below S-197 (in an area that they have been documented to frequent) that may result in a redistribution of manatee use in local estuarine coastal areas.

However, the Service has concerns about the benefits that will be provided by the proposed plan, given the changed scope of the project compared to what was envisioned in the Restudy. We are concerned that the project has been divided into two phases, and we are concerned that Phase 2 may not be implemented due to various reasons, such as land availability and Federal and State budget uncertainties. We recommend that Phase 2 be planned and implemented as soon as possible. We also recommend that additional planning, implementation, evaluation, and monitoring for Phase 1 be conducted with the intent to provide information into planning for, and ultimately result in, improved implementation of Phase 2, as well as optimizing mutually beneficial aspects of the two phases.

The Service is also concerned about the lack of available freshwater for the project to fully realize the conceptualized project and ecological benefits. As other features of the CERP are designed and operated, water management protocols for C-111SC Project components need to be reconsidered in the context of the modified C&SF Project. This may include provisions for a future increase in water availability, storage capacity and treatment, and modification of operations for elements of the selected plan to benefit Florida Bay, its coastal wetlands, and the Southern Glades, that are consistent with the C-111SC Phase 1 and Phase 2 goals and objectives.

Given the uncertainties inherent in modeling provided as part of planning for this project and the high level of uncertainty of the effects from implementing the proposed project, the implementation of sound monitoring and adaptive management plans are critical to project success. The Service recommends close adherence to the water quality and ecological monitoring plans developed for the C-111SC Project, including the ecological monitoring specified in the RECOVER Monitoring and Assessment Plan and the project-level monitoring plans appearing in the PIR. Also, the Service recommends that an adaptive management plan be developed for the project and implemented to maximize the restoration success of the project and to provide information for the planning and construction of Phase 2 of the project. This process should facilitate the restoration and enhancement of the C-111SC Project's wetland and estuarine habitats.

The spatial scope of the C-111SC Project envisioned by the Restudy was redirected to maximize restoration aspects of Taylor Slough and Florida Bay. An increment of progress towards this restoration may be accomplished in Phase 1 but possibly at the expense of some impacts to the CSSS and some marshland habitat areas in the lower C-111 canal in the ENP panhandle area. Even though the project has diminished significantly in spatial scale of anticipated benefits from what was originally envisioned, the Service continues to support the project as an important first step in restoring the project study area marshlands, near shore waters of Florida Bay and the adjacent coastal wetlands. However, the Service encourages the Corps and District to seek opportunities and creative means to more fully achieve the extent of restoration in the C-111SC study area envisioned by the Restudy during Phase 2 of the C-111SC Project.

Analysis of the Modbranch model used to simulate effects of implementation of the recommended plan indicates that there will potentially be a negative effect on the habitat of the CSSS, particularly subpopulation D. As much as 22 percent of the critical habitat in subpopulation D may be affected by extension of the hydroperiod beyond the range that is conducive to growing vegetation utilized by sparrows for nesting. Spatial analysis further reveals that some of the acreage that may be affected is outside areas presently being utilized by sparrows. In addition the model indicates that there are other habitat areas both within and outside of designated critical habitat areas that may, in the with-project model scenario, actually be benefited by obtaining the desired hydroperiod window needed for sparrow nesting habitat maintenance. Considering with the inherent uncertainties both in model output accuracy and the nature of project effects subject to implementation and operation, the inclusion of enhanced monitoring, safeguards based on incremental test stage operations, and development of a CSSS management plan including habitat enhancement activities offers the best opportunity to better understand project effects in the project study area and formulate safeguards and management measures to the overall benefit of the sparrow population.

Prior to initiating project operations, further analysis of project effects on hydrologic conditions in CSSS critical habitat areas in subpopulations C and D should be conducted to facilitate preparation of operational plans that consider sparrows and other species and habitats to maximize overall project benefits. These operations could be related to specific trigger cells located at key locations at verified ground elevations that help improve restoration and address uncertainty in modeling. An operations schedule should consider project structure operations during time periods key to sparrow life history requirements and broader benefits to fish and wildlife resources. Monitoring of hydroperiod, water depth and vegetative community composition needs to be an integral part of the baseline and post construction and operation ecological monitoring plan not only in sparrow habitat areas, but all areas of the project study area affected by hydrological changes.

Due to the anticipated changes of the project indicated by model output, current annual vegetation surveys need to be continued and additional transects monitored in critical habitat areas as well as expanded to areas outside the critical habitat that model output indicates will be affected by hydroperiod changes potentially beneficial to sparrows and to better monitor areas that may currently be utilized by CSSS. These surveys should include transects that include observations of vegetation, periphyton, soils, and topography. Critical habitat in the project study area should have extensive ground elevation surveys performed to facilitate a better understanding of sparrow habitat conditions and project operations as well as enhancing the ability to protect important core sparrow habitat.

The Corps and District should prepare and implement a CSSS management plan for the C-111SC Project study area in consultation with the Service. The management plan would include identification of potential sparrow habitat expansion outside of designated critical habitat areas, recommended management and monitoring, and other possible habitat enhancement measures both within critical habitat and in potential expansion areas, including woody vegetation removal, fire management, and creation of sawgrass refugia.

Environmental assessments in the C-111SC Project area have revealed contamination of soils in some areas. In some cases, the contamination detected is at a level that is toxic to fish and wildlife. The detected levels of contaminants, specifically copper, in the FPDA present a concern for Service trust resources, including the endangered Everglade snail kite, migratory birds, and resident wildlife species. Sampling of ambient conditions in major portions of the project footprint with the changed location has now been conducted. The Service has concurred with the District recommendation to scrape the FPDA footprint subject to confirmatory sampling of copper residues. Appendix F provides further detail on the Service concurrence and recommendations. To date, the provided Modbranch modeling indicates that in an average year up to 90 acres of the FPDA could be inundated for 80 days or longer at an average depth of 1 ft. These conditions could sustain a short hydroperiod wetland vegetation community and its associated fauna, which have the potential for contaminant uptake and bioaccumulation. To prevent potential contaminant exposure to fish and wildlife resources, corrective actions may be needed.

The water quality of the C-111E canal has potential for disrupting the ecology of marsh areas that may be receiving inflows. Pumping operations that are part of the C-111SC Design Test Project and future full scale spreader canal implementation in Phase 2 could result in this impaired quality water potentially entering surrounding marshes. The Service recommends that planning for the C-111SC Water Quality Pilot Project be resumed and the proposed project implemented after a full analysis of feasibility. Contaminants including selenium, chlordane, lead, and other toxics have been documented at levels of concern in soils within the potential footprint and effects area of the C-111SC Design Test Project and the proposed future full scale C-111SC as part of Phase 2. Additional sampling was conducted over a more refined impact area of the Design Test Project with more accurate laboratory detection limits. This analysis showed that the original contaminant levels were unlikely to pose ecological risk upon flooding and that the study area was suitable for the purpose of the proposed Design Test Project. To prevent potential contaminant exposure to fish and wildlife resources, corrective actions may still be needed in the larger scale spreader canal implementation if the project proceeds in the potential footprint that was analyzed. The Service's Environmental Contaminants staff will continue to review the assessment reports, and based on the potential risk indicated by limited soil sampling and food chain modeling, the Service will make specific recommendations for corrective actions and monitoring to the District.

The Service recommends that the Corps, District, and C-111SC PDT work collaboratively to develop a water quality monitoring plan and sampling points for both surface and groundwater that may include new well points or monitoring locations at areas of concern (such as the FPDA feature, the Aerojet Canal feature, the C-111 Design Test project, and the C-111SC Phase 2 proposed full scale spreader canal potential corridor) and additional parameters sampled to adequately assess environmental risk. If contaminants are found during project monitoring at levels that exceed those established by the EPA to protect aquatic life (EPA 2002) the Corps should modify project operation and monitoring accordingly and coordinate with the Service and other stakeholders.

The recommendations made by the Service on this project are intended to make this project more environmentally compatible and to further enhance the diversity and abundance of fish and wildlife resources in the project area, while assuring that maximum ecological benefits are delivered to Florida Bay and adjacent coastal wetlands consistent with the basic project purpose. The above listed Service recommendations are designed to minimize potential adverse impacts to fish and wildlife resources from the proposed action.

The Service reiterates that we support the C-111SC Project recommended plan as a first step in restoring freshwater wetlands and the near shore waters of Florida Bay and the adjacent tidal wetlands. Even though the spatial extent of wetland restoration envisioned by the Restudy will not be realized by the proposed project, the redistribution of freshwater across the study area to a more natural flow should improve ecological conditions in the project area. The Service appreciates the cooperation of the C-111SC PDT in responding to our concerns and recommendations throughout the planning process. We remain committed to assist in addressing our remaining recommendations to further enhance fish and wildlife resources as detailed project plans are reviewed and the project is constructed, and we look forward in providing assistance to planning and implementing Phase 2 of the C-111SC Project.

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Table 1. Common vegetation occurring in ecological zones in the C-111SC Project study area.

Zone	Common Vegetation Within C-111SC Project Ecological Zones
2	Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina* spp.), dahoon holly (*Ilex cassine*), swamp bay (*Persea palustris*), sweet bay (*Magnolia virginiana*), willow (*Salix caroliniana*), sawgrass (*Cladium jamaicense*)
3	Sawgrass, muhly grass (*Muhlenbergia capillaris*), swamp bay, dahoon holly, wax myrtle (*Myrica cerifera*), willow, and cocoplum (*Chrysobalanus icaco*), sweet bay, myrsine (*Rapanea guianensis*), bald cypress (*Taxodium distichum*), pond apple (*Annona glabra*)
4	Sawgrass, swamp bay, dahoon holly, wax myrtle, cocoplum, myrsine, poisonwood (*Metopium toxiferum*), buttonwood (*Conocarpus erectus*), red mangrove (*Rhizophora mangle*), stoppers (*Eugenia* spp.), spicewood (*Calyptranthes pallens*), cocoplum
5	dwarf red mangroves, sparse graminoids
6	Red mangrove, white mangrove (*Laguncularia racemosa*), Brazilian pepper , Australian pine, wax myrtle,, poisonwood,, buttonwood, spicewood, myrsine, stoppers, white indigo berry (*Randia aculeata*)

Table 2. Acreage of ecological zones in the C-111SC Project study area including indicator regions utilized in benefit calculations. Inset illustrates location in the project study area.

Landscapes	**Landscape Type**	**Zone A Acreage**	**Zone B Acreage**	**Zone C Acreage**	**Zone D Acreage**	**Type Totals**
Shrub dominated forested wetland	2	439	4,406	1,086	6,836	12,767
Sawgrass	3	13,647	29,271	6,403	16,990	66,311
Mixed graminoid with mangrove	4	3,716	2,832	3,179	823	10,550
White zone ecotone	5	6,439	7,051	3,035	5,223	21,748
Coastal forest	6	8,074	5,707	1,892	1,938	17,611
	Zone Totals	**32,315**	**49,267**	**15,595**	**31,810**	**128,987**
Indicator Regions	**Indicator Region Acreage**					
Long sound	2,153					
Joe Bay	3,389					
Little Madeira Bay	2,361					
Manatee Bay	2,497					
Barnes Sound	16,902					
Northeastern Florida Bay	70,000					
Taylor Slough	26,111					
Indicator Region Totals	**123,413**					
Total Applicable Acreage	**252,400**					

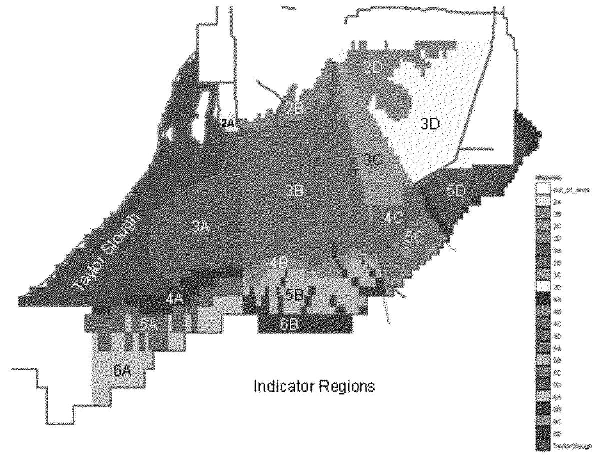


Table 3. List of fish and wildlife species, not protected under Act, likely to occur in the C-111SC Project study area.

Birds

Common Name	Scientific Name
great egret	*Casmerodius albus*
snowy egret	*Egretta thula*
cattle egret	*Bubulcus ibis*
great blue heron	*Ardea herodias*
little blue heron	*Florida caerulea*
tricolor heron	*Hydranassa tricolor*
black-crowned night heron	*Nycticorax nycticorax*
yellow-crowned night heron	*Nyctanassa violacea*
green heron	*Butorides striatus*
wood stork	*Mycteria americana*
limpkin	*Aramus guarauna*
white ibis	*Eudocimus albus*
glossy ibis	*Plegadis falcinellus*
black-necked stilt	*Himantopus mexicanus*
greater yellow-legs	*Tringa melanoleuca*
lesser yellow-legs	*Tringa flavipes*
willet	*Catoptrophorus semipalmatus*
roseate spoonbill	*Ajaia ajaja*
double crested cormorant	*Phalacrocorax auritus*
hooded merganser	*Lophodytes cucullatus*
American anhinga	*Anhinga anhinga*
American coot	*Fulica americana*
gallinule	*Gallinula chloropus*
king rail	*Rallus elegans*
pied-bill grebe	*Podilymbus podiceps*
killdeer	*Charadrius vociferus*
common snipe	*Capella gallinago*
osprey	*Pandion haliaetus*
swallow-tailed kite	*Elanoides forficatus*
red-shouldered hawk	*Buteo lineatus*
red-tailed hawk	*Buteo jamaicensis*
Swainson's hawk	*Buteo regalis*
short-tailed hawk	*Buteo brachyurus*
merlin	*Falco columbarius*
American kestrel	*Falco sparverius*
northern harrier	*Circus cyaneus*
marsh hawk	*Circus cyaneus*
turkey vulture	*Cathartes aura*

Birds

Common Name	**Scientific Name**
black vulture	*Coragyps atratus*
belted kingfisher	*Megaceryle alcyon*
loggerhead shrike	*Lanius ludovicianus*
red-bellied woodpecker	*Melanerpes carolinus*
common flicker	*Colaptes auratus*
Eastern meadowlark	*Sturnella magna*
common yellowthroat	*Geothlypis trichas*
common nighthawk	*Chordeiles minor*
red-winged blackbird	*Agelaius phoeniceus*

Fish

Common Name	**Scientific Name**
Small species	
mosquitofish	*Gambusia holbrooki*
sailfin molly	*Poecilia latipinna*
sheepshead minnow	*Cyprinodon variegatus*
lake chubsucker	*Erimyzon sucetta*
topminnows	*Fundulus* spp.
least killifish	*Heteranda formosa*
marsh killifish	*Fundulus confluentus*
flagfish	*Jordanella floridae*
bluefin killifish	*Lucania goodei*
brook silverside	*Labidesthes sicculus*
coastal shiner	*Notropis petersoni*
everglades pygmy sunfish	*Elassoma evergladei*
dollar sunfish	*Lepomis marginatus*
bluegill	*Lepomis macrochirus*
redear sunfish	*Lepomis microlophus*
striped mullet	*Mugil cephalus*
inland silverside	*Menidia beryllina*
golden topminnow	*Fundulus chrysotus*
rainwater killifish	*Lucania parva*
tidewater mojarra	*Eucinostomus harengulus*
striped mojarra	*Eugerres plumieri*
naked goby	*Gobiosoma bosc*
crested goby	*Lophogobius cyprinoides*
clown goby	*Microgobius gulosus*
Large species	
bowfin	*Amia calva*
Florida gar	*Lepisosteus platyrhincus*

Fish

Common Name	**Scientific Name**
largemouth bass	*Micropterus salmoides floridanus*
redfin pickerel	*Esox americanus*
American eel	*Anguilla rostrata*
tarpon	*Megalops atlanticus*
snook	*Centropomus undecimalis*
spotted seatrout	*Cynoscion nebulosus*
redfish	*Sciaenops ocellatus*
sheepshead	*Archosargus probatocephalus*
crevalle jack	*Caranx hippos*
gray snapper	*Lutjanus griseus*
hardhead catfish	*Ariopsis felis*
sunfish	*Lepomis* spp.
bullhead	*Ameiurus* spp.
catfish	*Ameiurus* and *Ictalurus* spp.
Exotic species	
jewelfish	*Hemichromis letoumeauxi*
black acara	*Cichlasoma bimaculatum*
pike killifish	*Belonesox belizanus*
Nicaraguan cichlid	*Cichlasoma managuense*
spotted tilapia	*Tilapia mariae*
blue tilapia	*Oreochromis aurea*
Mayan cichlid	*Ciclasoma urophthalmus*
jaguar guapote	*Cichlasoma managuense*
oscar	*Astronotus ocellatus*
walking catfish	*Clarias batrachus*
armored catfish	*Hoplosternum littorale*
peacock bass	*Cichla ocellaris*

Amphibians and reptiles

Common Name	**Scientific Name**
southern leopard frog	*Rana sphenocephala*
green treefrog	*Hyla cinerea*
Cuban treefrog	*Osteopilus septentrionalis*
greenhouse frog	*Eleutherodactylus planirostris*
oak toad	*Bufo quercicus*
pig frog	*Rana grylio*
greater siren	*Siren lacertina*
brown anole	*Anolis sagrei*
green anole	*Anolis carolinensis*
black racer	*Coluber constrictor*
Florida green water snake	*Nerodia floridana*
Florida water snake	*Nerodia fasciata*
Water Moccasin	*Ancistrodon piscivorus*
American alligator	*Alligator mississippiensis*
gopher tortoise	*Gopherus polyphemus*
Florida softshell turtle	*Apalone ferox*
striped mud turtle	*Kinostemon baurii*
chicken turtle	*Deirochelys reticularia*
Florida Red-bellied Cooter	*Pseudemys nelsoni*

Mammals

Common Name	**Scientific Name**
raccoon	*Procyon lotor*
gray fox	*Urocyon cinereoargenteus*
white-tailed deer	*Odocoileus virginianus*
nine-banded armadillo	*Dasypus novemcinctus*
Virginia opossum	*Didelphis virginiana*
bobcat	*Felis rufus*
river otter	*Lutra canadensis*
marsh rabbit	*Sylvilagus palustris*
hispid cotton rat	*Sigmodon hispidus*
marsh rice rat	*Orzomys palustris*
cotton mouse	*Peromyscus gossypinus*

Table 4. Estimated numbers of CSSS within subpopulations A through F from 1981 to 2008. Two surveys were conducted in 2000.

Year	Subpopulation						Total
	A	B	C	D	E	F	
1981	2,688	2,352	432	400	672	112	6,656
1992	2,608	3,184	48	112	592	32	6,576
1993	432	2,464	0	96	320	0	3,312
1994	80	2,224	NE	NE	NE	NE	2,416
1995	240	2,128	0	0	352	0	2,720
1996	384	1,888	48	80	208	NE	2,624
1997	272	2,832	48	48	832	16	4,048
1998	192	1,808	80	48	912	16	3,056
1999	400	2,048	144	176	768	16	3,552
2000a	448	1,824	112	64	1,040	0	3,488
2000b	400	2,448	64	16	704	112	3,744
2001	128	2,128	96	32	848	32	3,264
2002	96	1,904	112	0	576	16	2,704
2003	128	2,368	96	0	592	32	3,216
2004	16	2,784	128	0	640	16	3,854
2005	96	2,272	80	48	576	32	3,104
2006	112	2,080	160	3	704	32	3,088
2007	64	2,080	48	3	560	0	2,752
2008	112	NE	48*	(5)	560*	0	NA

NE = not estimated.

<u>2008</u>
B not surveyed
C *stable, similar to last year
D (males observed, no nesting)
E *stable, similar to last year

Table 5. Habitat units calculated using benefit methodology utilized to select the proposed alternative (IORLO2_2Ds). Total habitat Units and net difference comparing Future Without Project (FWO) condition and C-111SC Project alternatives. Data are normalized to adjust for double counting of application areas. PM2.1 computed using average of result.

	TOTAL HABITAT UNITS				NET HABITAT UNITS FROM FWO				
	PM 1.5	PM 2.4	PM 2.1	All 3 PMs	PM 1.5	PM 2.4	PM 2.1	All 3 PMs	Average Annual Lift
ECB	59,288	19,547	67,564	146,400					
FWO	57,640	19,714	67,055	144,410					
Alt_1C	61,387	17,411	65,905	144,703	3,747	(2,303)	(1,150)	293	253
Alt_1D	61,947	16,735	66,745	145,427	4,307	(2,979)	(310)	1,018	881
Alt_2DS	61,758	17,615	70,816	150,188	4,117	(2,100)	3,761	5,779	5003
Alt_2DL	61,461	17,789	69,268	148,517	3,821	(1,925)	2,212	4,108	3556
Alt_3D	60,354	17,440	69,002	146,797	2,714	(2,274)	1,947	2,387	2067
Alt_6D	63,781	18,849	72,298	154,928	6,141	(865)	5,243	10,519	9108

Table 6. CSSS performance measures by representative year modeled (average, dry, wet), comparing Initial Operations (IORLO2) to Initial Operations with project alternative 2DShort (IORLO2_2Ds) for subpopulation B.

CSSS Habitat U1 (B), Total number of acres = 39029

	1978 (average)		1989 (dry)		1995 (wet)	
Simulation:	IORLO2_78	IORLO2_2Ds_78	IORLO2_89	IORLO2_2Ds_89	IORLO2_95	IORLO2_2Ds_95
Area with 60d<HP<180d (acres)	25169	25169	2304	2304	313	313
Area Weighted Average HP in areas with 60-180d HP (days)	136	136	92	92	155	155
Area with Max Continuous Dry Days > 80 days (acres)	21920	21920	38572	38572	8418	8418
Area Weighted Average of Maximum Continuous Dry Days in the areas with > 80 days (days)	117	117	137	137	92	92
Area Weighted Average of Maximum Continuous Dry Days in all areas (days)	85	85	137	137	52	52
Area with Maximum Wet Depth > 20 cm equal or greater than 1 day, 15 March - 30 June (acres)	0	0	0	0	12454	12557
Area with Maximum Wet Depth > 20 cm more than 30 days, 15 March - 30 June (acres)	0	0	0	0	1869.1	1869.1
Area Weighted Average of Number of Days Depth > 20 cm for more than 30 days, 15 March - 30 June (days)	0	0	0	0	95	95

Performance Measures

Table 7. CSSS performance measures by representative year modeled (average, dry, wet), comparing Initial Operations (IORLO2) to Initial Operations with project alternative 2DShort (IORLO2_2Ds) for subpopulation C.

Performance Measures

CSSS Habitat U2 (C), Total number of acres = 8304

	1978 (average)		1989 (dry)		1995 (wet)	
Simulation:	IORLO2_78	IORLO2_2Ds_78	IORLO2_89	IORLO2_2Ds_89	IORLO2_95	IORLO2_2Ds_95
Area with 60d<HP<180d (acres)	3240	4682	0	0	5771	4451
Area Weighted Average HP in areas with 60-180d HP (days)	95	98	0	0	135	150
Area with Max Continuous Dry Days > 80 days (acres)	8304	8304	8304	8304	8305	8304
Area Weighted Average of Maximum Continuous Dry Days in the areas with > 80 days (days)	138	138	138	138	117	116
Area Weighted Average of Maximum Continuous Dry Days in all areas (days)	138	138	138	138	117	116
Area with Maximum Wet Depth > 20 cm equal or greater than 1 day, 15 March - 30 June (acres)	0	0	0	0	0	17
Area with Maximum Wet Depth > 20 cm more than 30 days, 15 March - 30 June (acres)	0	0	0	0	0	0
Area Weighted Average of Number of Days Depth > 20 cm for more than 30 days, 15 March - 30 June (days)	0	0	0	0	0	0

Table 8. CSSS performance measures by representative year modeled (average, dry, wet), comparing Initial Operations (IORLO2) to Initial Operations with-project alternative 2DShort (IORLO2_2Ds) for subpopulation D.

CSSS Habitat U3 (D), Total number of acres = 10806

Performance Measures	1978 (average)		1989 (dry)		1995 (wet)	
Simulation:	IORLO2_78	IORLO2_2Ds_78	IORLO2_89	IORLO2_2Ds_89	IORLO2_95	IORLO2_2Ds_95
Area with 60d<HP<180d (acres)	8763	7157	57	77	3675	2254
Area Weighted Average HP in areas with 60-180d HP (days)	124	153	89	86	154	137
Area with Max Continuous Dry Days > 80 days (acres)	10302	10065	10806	10806	10284	9638
Area Weighted Average of Maximum Continuous Dry Days in the areas with > 80 days (days)	132	123	138	138	115	106
Area Weighted Average of Maximum Continuous Dry Days in all areas (days)	128	119	138	138	112	100
Area with Maximum Wet Depth > 20 cm equal or greater than 1 day, 15 March - 30 June (acres)	11	36	0	0	128	173
Area with Maximum Wet Depth > 20 cm more than 30 days, 15 March - 30 June (acres)	0	0	0	0	0	35.8
Area Weighted Average of Number of Days Depth > 20 cm for more than 30 days, 15 March - 30 June (days)	0	0	0	0	0	33

Table 9. CSSS subpopulation D critical habitat (CH). Discontinuous hydroperiod (HP, total days per year) for initial operations, compared to initial operations with Alternative 2DShort for 1978 (an average year) and separated by incremental ground surface elevation in designated CH.

		CSSS Habitat Ave. Discontinuous HP/Year		
Ground Surface Elevation (ft.) NGVD29	**Total Acres/ Elevation**	**1978 Initial Operations (Days)**	**1978 Initial Operations With Project (Days)**	**1978 Change With Project (Days)**
1.6	11	202	210	8
1.7	14	174	190	16
1.8	29	146	167	21
1.9	374	192	209	17
2.0	532	162	182	20
2.1	717	165	192	27
2.2	570	162	182	20
2.3	875	152	183	31
2.4	1,066	153	182	29
2.5	1,321	135	176	41
2.6	1,299	120	176	56
2.7	931	101	171	70
2.8	1,265	81	165	84
2.9	1,011	64	142	78
3.0	529	64	124	60
3.1	182	61	115	54
3.2	65	57	114	57
3.3	15	41	110	69

Total Acres In CSSS-D CH 10,806

Total Acres w/60-180 HP Initial Operations .....10,341.......(96% of Total)

Total Acres w/60-180 HP Initial Operations
w/Project ....6,647.........(62% of Total)

Table 10. Difference in wading bird performance criteria calculated habitat units by month and modeled year, comparing IOR and IOR with project alternative 2DShort. Habitat units are calculated for the optimal 23 percent of available foraging habitat preferentially selected by foraging species (Gawlik et al. 2004). Data is summarized for the project study area and for the Taylor Slough indicator region.

Total Study Area Net Ave. Monthly Change

	Monthly Average Wading Bird Habitat Units					
Total Acres = 155098 23% of Area = 35671	November	December	January	February	March	April
IOR - IORw/Proj_78 (avg)	-878	-419	94	353	42	-43
IOR - IORw/Proj_89 (dry)	-6	-339	-5	20	1	-13
IOR - IORw/Proj_95 (wet)	45	-7122	1659	346	799	-180

Taylor Slough Net Ave. Monthly Change

	Monthly Average Wading Bird Habitat Units					
Total Acres = 26105 23% of Area = 6004	November	December	January	February	March	April
IOR - IORw/Proj_78 (avg)	0	0	14	-12	11	28
IOR - IORw/Proj_89 (dry)	21	-16	-28	8	0	0
IOR - IORw/Proj_95 (wet)	0	-3761	49	254	54	-79

Key	**% Change of 23% Optimal Habitat**	> 50	10 to 50	>0 to <10	0	< 0 to > -10	-10 to > -50	< -50

Table 11. Difference in wading bird performance criteria calculated habitat units, by month and modeled year, comparing IOR, and IOR with project alternative 2DShort. Habitat units are calculated for the optimal 23 percent of available foraging habitat preferentially selected by foraging species (Gawlik et al. 2004). Data is summarized for project indicator regions 3A, 3B, 3C, and 3D.

Indicator Region 3A Net Ave. Monthly Change

Total Acres = 13650 23% of Area = 3139	**Monthly Average Wading Bird Habitat Units** November	December	January	February	March	April
IOR - IORw/Proj_78 (avg)	-1273	-662	-3	9	26	0
IOR - IORw/Proj_89 (dry)	0	0	0	0	0	0
IOR - IORw/Proj_95 (wet)	-479	-2405	-86	-77	-108	54

Indicator Region 3B Net Ave. Monthly Change

Total Acres = 29271 23% of Area = 6732	**Monthly Average Wading Bird Habitat Units** November	December	January	February	March	April
IOR - IORw/Proj_78 (avg)	-101	-4	32	58	0	0
IOR - IORw/Proj_89 (dry)	0	0	0	0	0	0
IOR - IORw/Proj_95 (wet)	604	-1057	50	-83	1173	0

Indicator Region 3C Net Ave. Monthly Change

Total Acres = 6403 23% of Area = 1473	**Monthly Average Wading Bird Habitat Units** November	December	January	February	March	April
IOR - IORw/Proj_78 (avg)	21	-59	32	187	0	0
IOR - IORw/Proj_89 (dry)	0	0	0	0	0	0
IOR - IORw/Proj_95 (wet)	12	1	3	6	-35	0

Indicator Region 3D Net Ave. Monthly Change

Total Acres = 16990 23% of Area = 3908	**Monthly Average Wading Bird Habitat Units** November	December	January	February	March	April
IOR - IORw/Proj_78 (avg)	318	0	0	0	0	0
IOR - IORw/Proj_89 (dry)	0	0	0	0	0	0
IOR - IORw/Proj_95 (wet)	1	907	1293	0	0	0

Key	**% Change of 23% Optimal Habitat**	> 50	10 to 50	>0 to <10	0	< 0 to > -10	-10 to > -50	< -50

Table 12. Difference in wading bird performance criteria calculated habitat units by month and modeled year, comparing IOR and IOR with project alternative 2DShort. Habitat units are calculated as in Table 11. The matrixes summarize model output for November, December and January (in columns), for average (1978, first matrix row), dry (1989, middle matrix row), and wet year (1995, bottom matrix row). The cell directly under the cell labeled TS is performance criteria for the Taylor Slough indicator regions.

Average:

November 1978

		A	B	C	D
TS	2	-2	73	-5	17
0	3	-1273	-101	21	318
	4	-78	53	12	19
	5	-33	57	16	32
	6	-26	22	16	-16

December 1978

		A	B	C	D
TS	2	31	513	4	0
0	3	-662	-4	-59	0
	4	-48	2	2	21
	5	-66	20	-20	53
	6	-10	-213	4	12

January 1978

		A	B	C	D
TS	2	0	0	0	0
14	3	-3	32	32	0
	4	-4	-3	-14	15
	5	1	3	2	24
	6	0	-3	1	-2

Dry:

November 1989

		A	B	C	D
TS	2	0	0	0	0
21	3	0	0	0	0
	4	1	0	-18	0
	5	1	0	-3	-6
	6	0	0	-1	-1

December 1989

		A	B	C	D
TS	2	0	0	0	0
-16	3	0	0	0	0
	4	-1	0	-22	0
	5	11	-7	3	-117
	6	-1	-186	0	-4

January 1989

		A	B	C	D
TS	2	0	0	0	0
-28	3	0	0	0	0
	4	-1	0	-4	0
	5	-1	-3	7	21
	6	0	0	0	4

Wet:

November 1995

		A	B	C	D
TS	2	-78	29	2	-11
0	3	-479	604	12	1
	4	0	48	224	6
	5	-136	16	-3	-18
	6	-51	-164	74	-33

December 1995

		A	B	C	D
TS	2	8	-95	-12	-53
-3761	3	-2405	-1057	1	907
	4	-124	-20	63	18
	5	-40	37	30	136
	6	-9	-790	11	31

January 1995

		A	B	C	D
TS	2	5	-21	5	273
49	3	-86	50	3	1293
	4	-4	41	-18	2
	5	1	66	2	33
	6	0	-29	24	-28

Key

% Change of 23% Optimal Habitat	> 50	10 to 50	>0 to <10	0	< 0 to > -10	-10 to > -50	< -50

Table 13. Difference in wading bird performance criteria (habitat units) by month and modeled year, comparing IOR and IOR with project alternative 2DShort. Habitat units are calculated as in Table 11. The matrixes summarize model output for February, March and April (in columns) for average (1978, first matrix row), dry (1989, middle matrix row), and wet year (1995, bottom matrix row). The cell directly under the cell labeled TS is performance criteria for the Taylor Slough indicator regions.

Average: 1978

	February A	February B	February C	February D	March A	March B	March C	March D	April A	April B	April C	April D
TS	-12				11				28			
2	0	0	0	0	0	0	0	0	0	0	0	0
3	9	58	187	0	26	0	0	0	0	0	0	0
4	-10	4	-1	14	15	-8	3	3	-24	0	-3	0
5	46	1	1	43	8	-1	-19	15	-49	-1	5	0
6	0	-3	1	17	-3	-3	-9	4	-1	0	2	0

Dry: 1989

	February A	February B	February C	February D	March A	March B	March C	March D	April A	April B	April C	April D
TS	8				0				0			
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	2	0	-1	0	0	0	0	0	0	0	3	0
5	3	0	9	0	0	0	1	0	1	0	-7	0
6	-1	0	0	0	-1	0	0	0	-5	0	-5	0

Wet: 1995

	February A	February B	February C	February D	March A	March B	March C	March D	April A	April B	April C	April D
TS	254				54				-79			
2	48	161	0	0	13	0	0	0	0	0	0	0
3	-77	-83	6	0	-108	1173	-35	0	54	0	0	0
4	8	2	0	57	-12	-112	7	4	-24	-14	-14	0
5	-14	32	-3	101	6	-52	4	26	-6	-91	6	0
6	1	-159	1	12	0	-233	11	53	-2	0	-8	-2

Key

% Change of 23% Optimal Habitat						
> 50	10 to 50	>0 to <10	0	< 0 to > -10	-10 to > -50	< -50

Table 14. Modeled flow output across Taylor Slough transects for the Initial Operations Regime (IORLO2) and the Initial Operations Regime with proposed project 2DShort (IORLO2_2Ds) including change with project (Δ), and change as percentage of IOR. Yearly total volumes in acre-feet, Layer 1 (Surface).

Flow Transect					
1978		**IORLO2_78**	**IORLO2_2Ds_78**	**Δ**	**Δ % IOR**
TSnorth		6	11	5	82
TSsouth		7824	11378	3554	45
TA-1		5955	7733	1778	30
TA-2		1915	4250	2335	122
TA-1,2 Total		7871	11983	4113	52
TB-1		6401	7162	761	12
TB-2		2604	3025	420	16
TB-1,2 Total		9006	10187	1181	13
1989		**IORLO2_89**	**IORLO2_2Ds_89**	**Δ**	**Δ % IOR**
TSnorth		0	0	0	0
TSsouth		5	5	0	0
TA-1		5	5	0	0
TA-2		0	0	0	0
TA-1,2 Total		5	5	0	0
TB-1		8	8	0	0
TB-2		2	2	0	0
TB-1,2 Total		10	10	0	0
1995		**IORLO2_95**	**IORLO2_2Ds_95**	**Δ**	**Δ % IOR**
TSnorth		989	6208	5220	528
TSsouth		17623	30930	13307	76
TA-1		12549	19240	6690	53
TA-2		6201	12904	6703	108
TA-1,2 Total		18751	32144	13393	71
TB-1		13082	18169	5087	39
TB-2		8689	11462	2773	32
TB-1,2 Total		21771	29631	7861	36

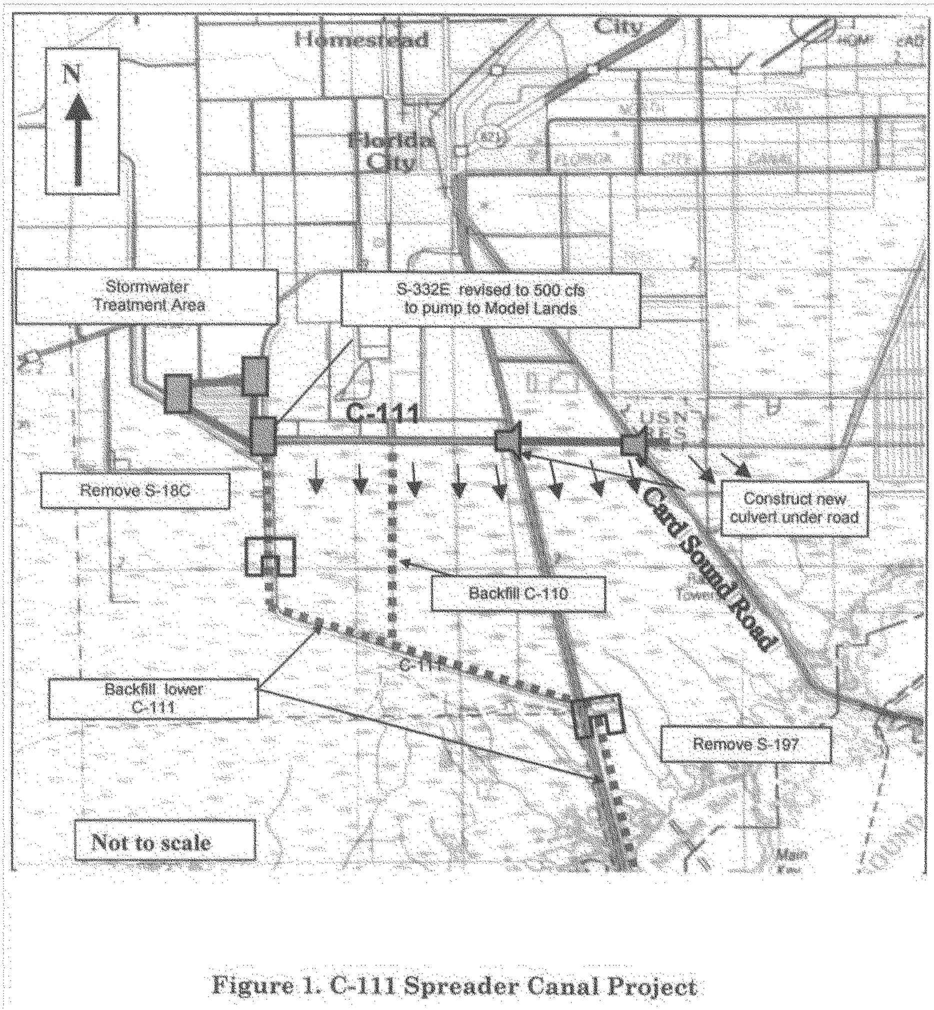


Figure 1. C-111SC Project original "Yellow Book" (Restudy) project conceptual diagram.

Figure 2. Location of the Southern Glades and the Model Lands in C-111SC Project study area.

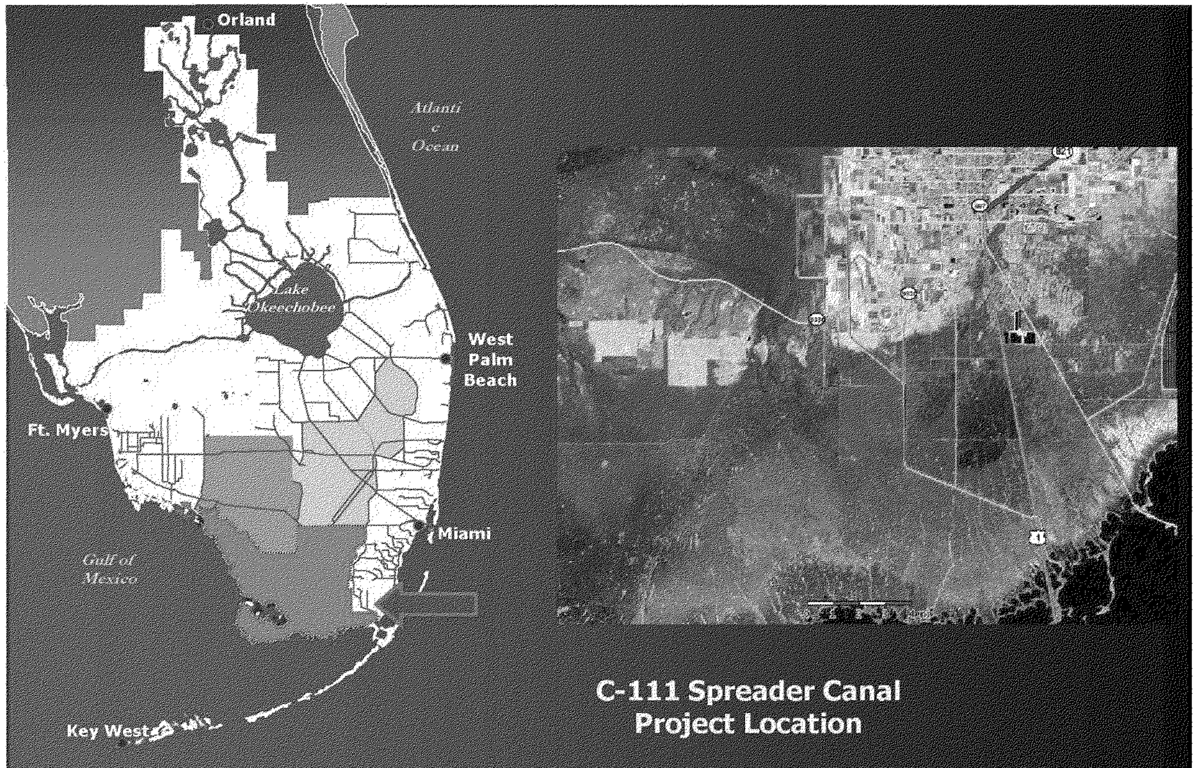


Figure 3. The C-111SC Project Location.

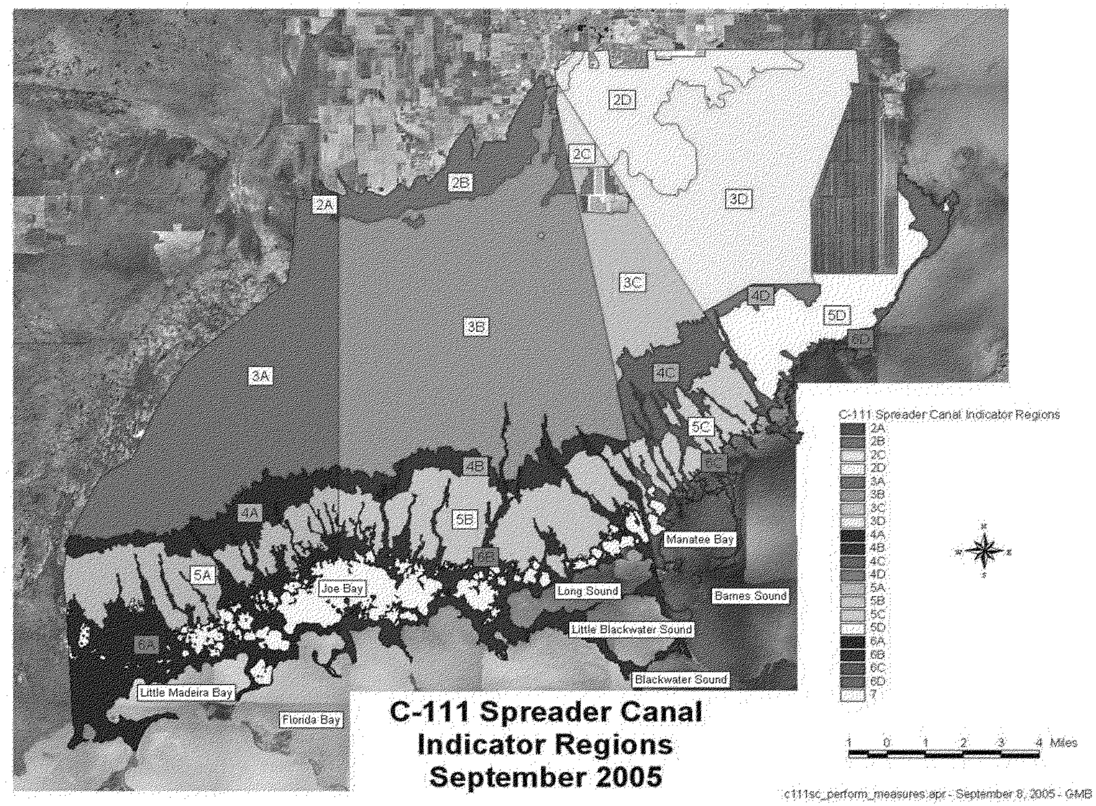


Figure 4. Location of C-111SC study area indicator regions 2A through 7 in relation to geographic features.

Figure 5. Location of Taylor Slough in C-111SC Project study area.

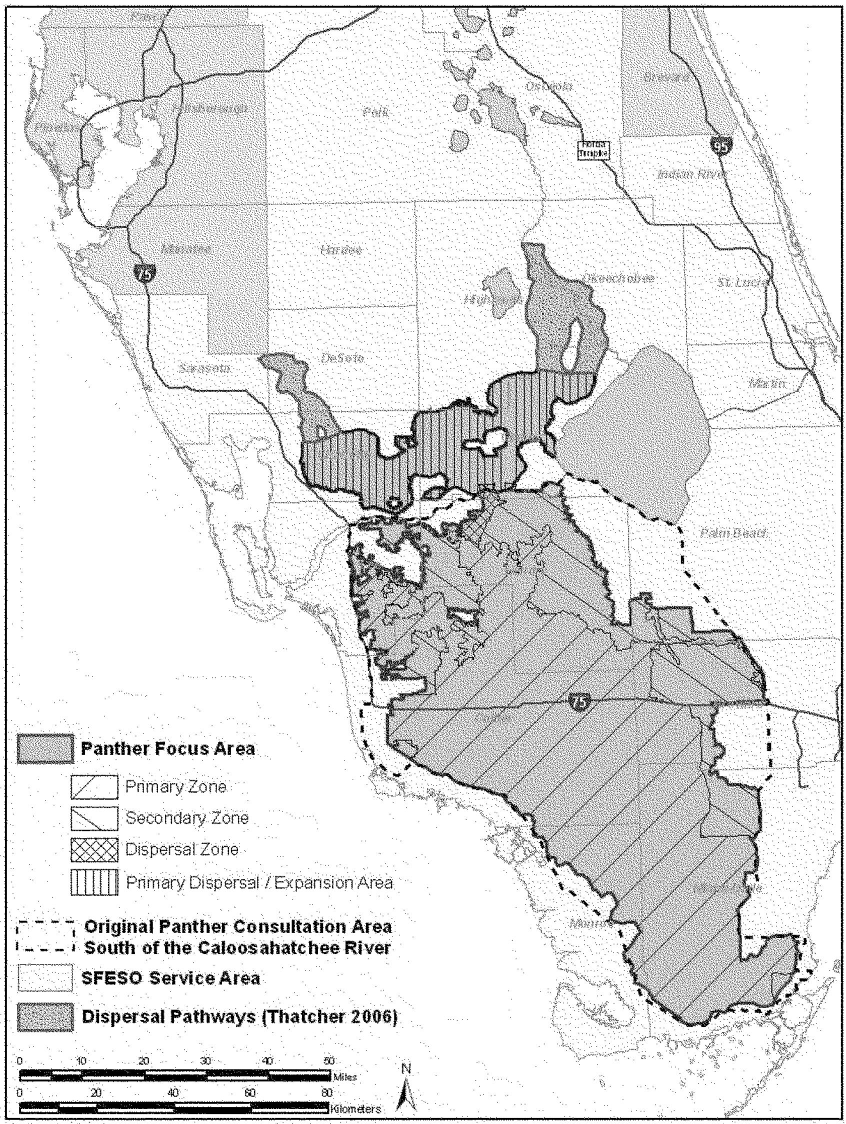


Figure 6. Florida Panther Focus Area including Primary Zone designation.

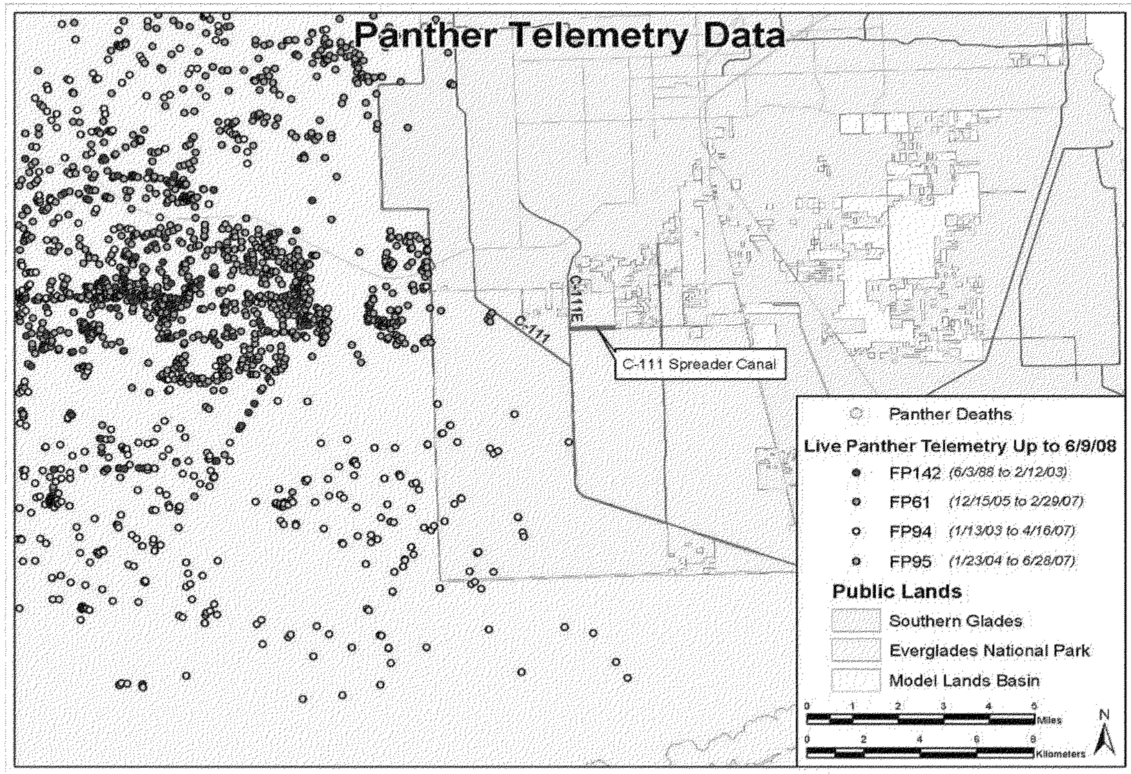


Figure 7. Live Florida panther telemetry locations in the C-111 SC Project study area, based upon data collected through June 9, 2008, by personnel from the FWC, Big Cypress National Preserve, and ENP (Service 2008).

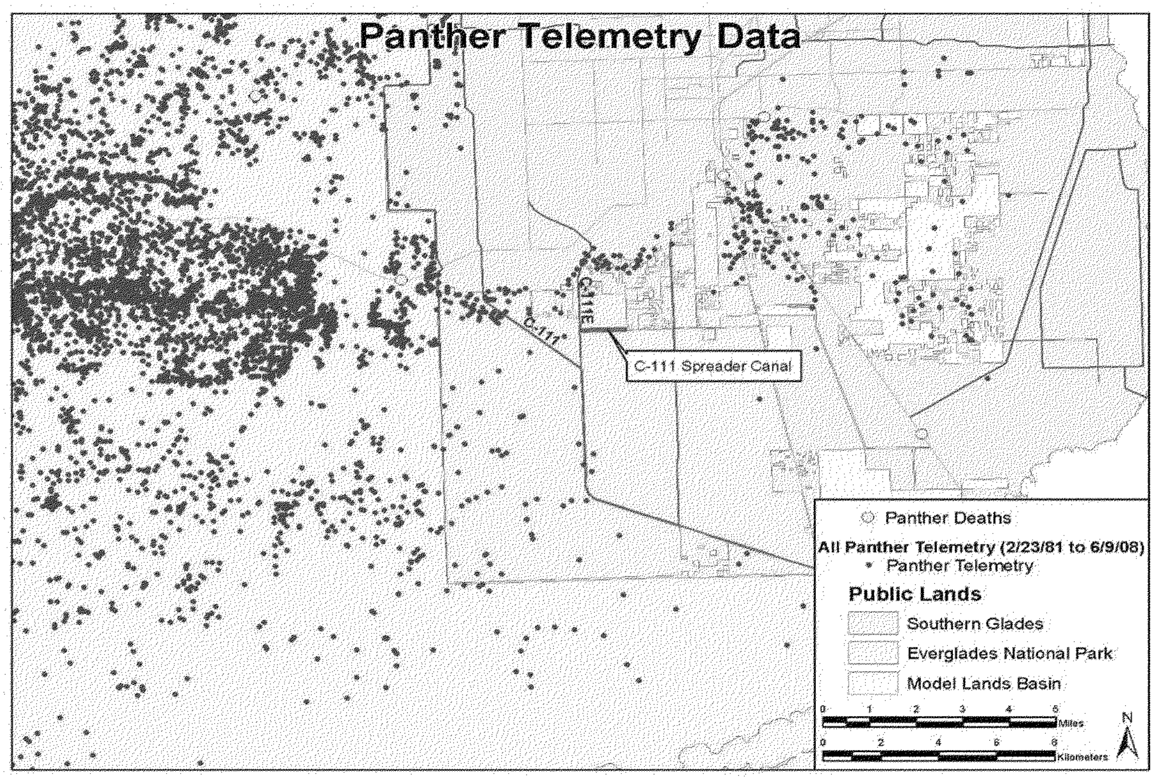


Figure 8. Florida panther telemetry locations in the C-111SC Project study area, based upon data collected from March 1981 through June 9, 2008 by personnel from the FWC, Big Cypress National Preserve, and ENP (Service 2008).

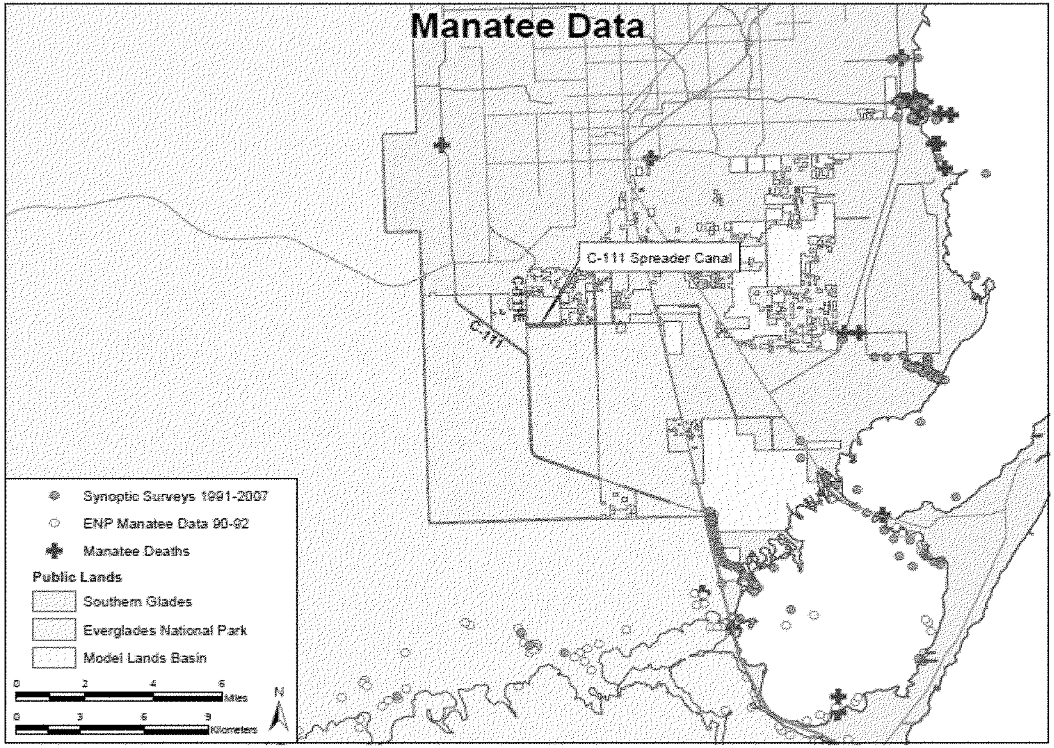


Figure 9. District canal infrastructure in the C-111SC Project study area and documented locations of West Indian manatee observations and mortalities.

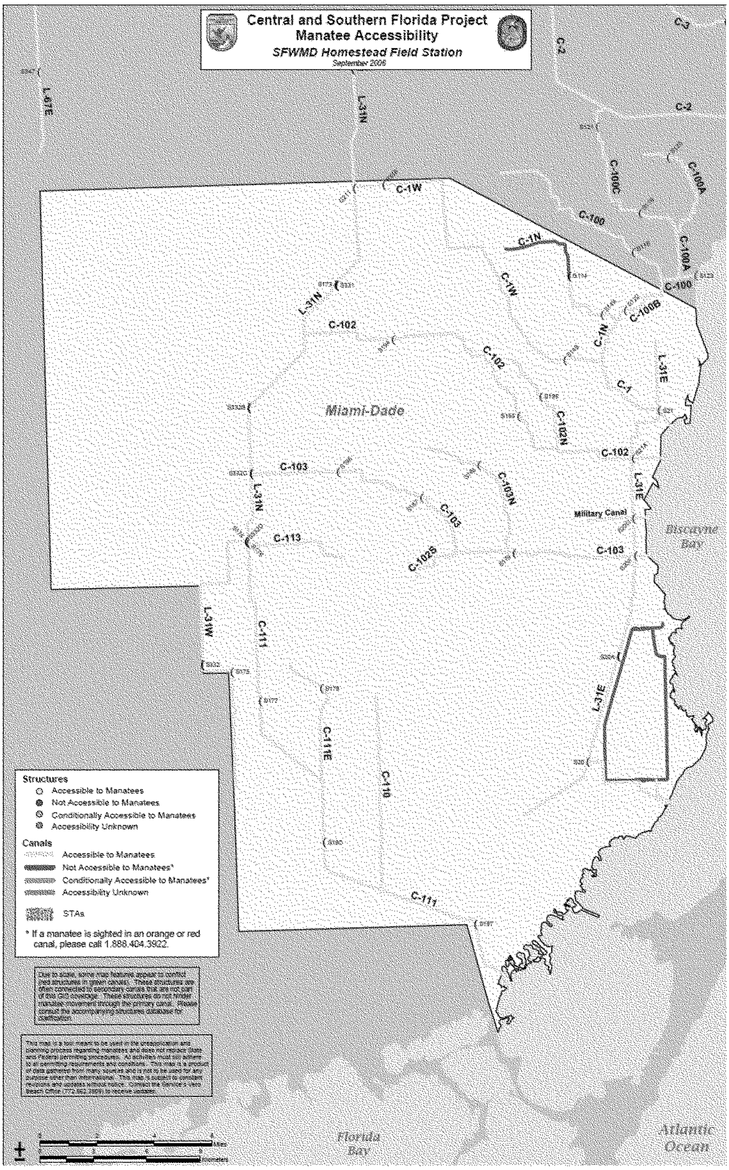


Figure 10. District canal infrastructure and West Indian manatee accessibility.

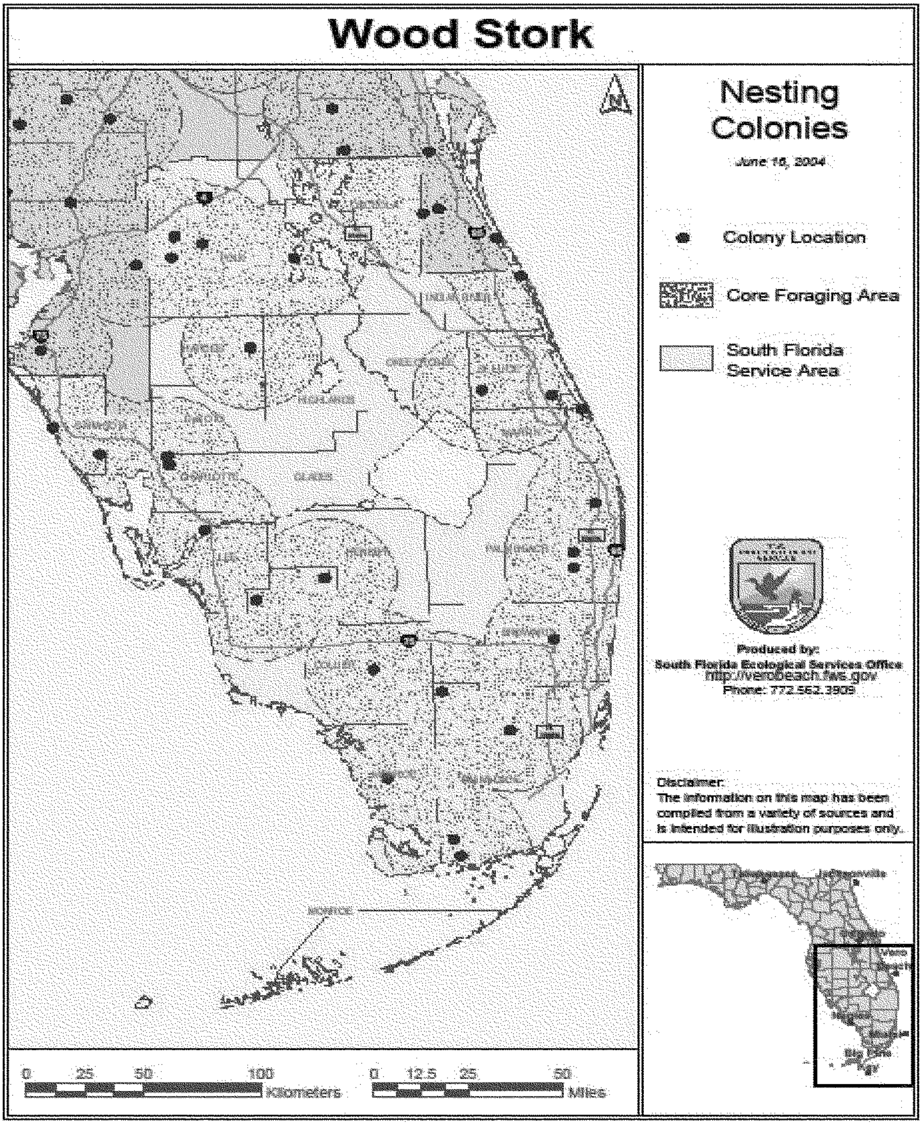


Figure 11. Wood stork nesting colony locations and core foraging areas documented in southern Florida.

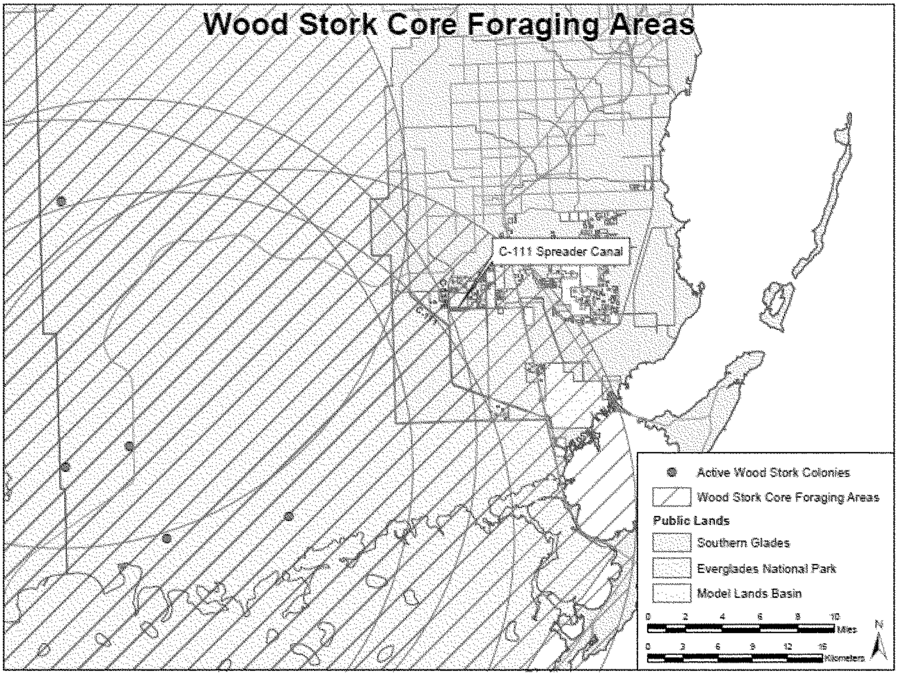


Figure 12. Wood stork core foraging Areas within the C-111SC Project Study Area.

Figure 13. Location of CSSS critical habitat areas B (Unit 1), C (Unit 2), D (Unit 3), E (Unit 4), and F (Unit 5) in relation to project study area features.

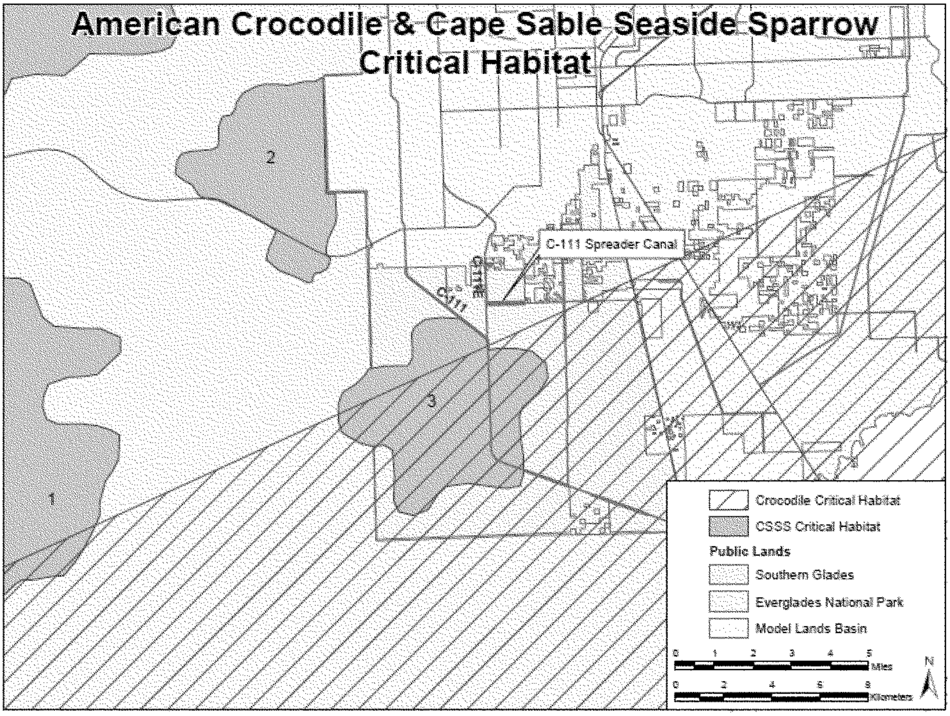


Figure 14. Location of critical habitat for the American crocodile and the CSSS within the C-111SC Project study area.

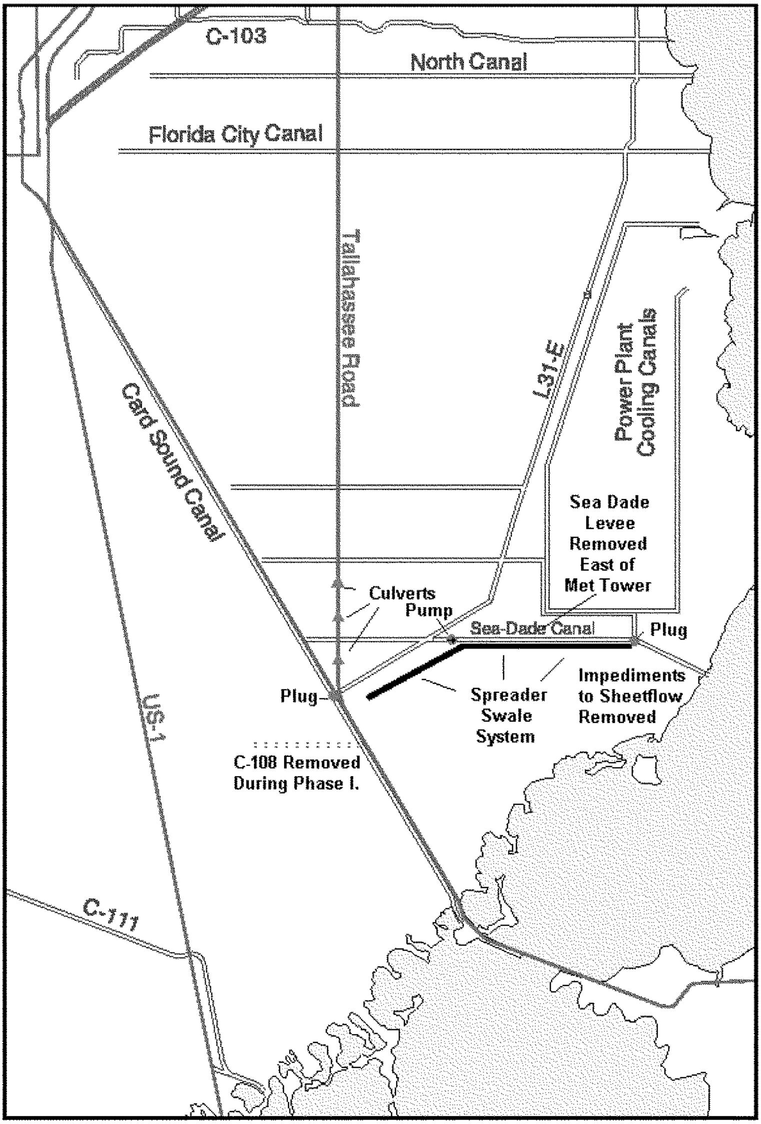


Figure 15. Florida Power and Light mitigation area location and proposed project components.

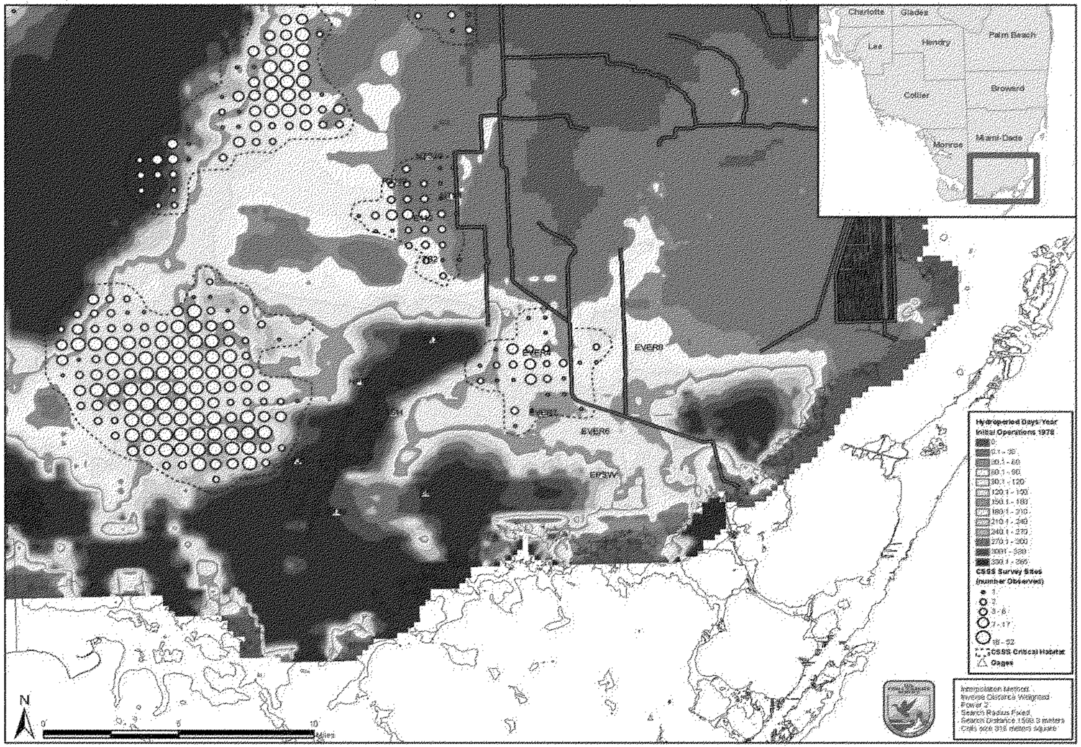


Figure 16. Location of CSSS critical habitat, survey sites, numbers observed, and relationship to C-111SC Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the initial operations regime (IOR) without the recommended Alternative 2DShort for the modeled year 1978 (average).

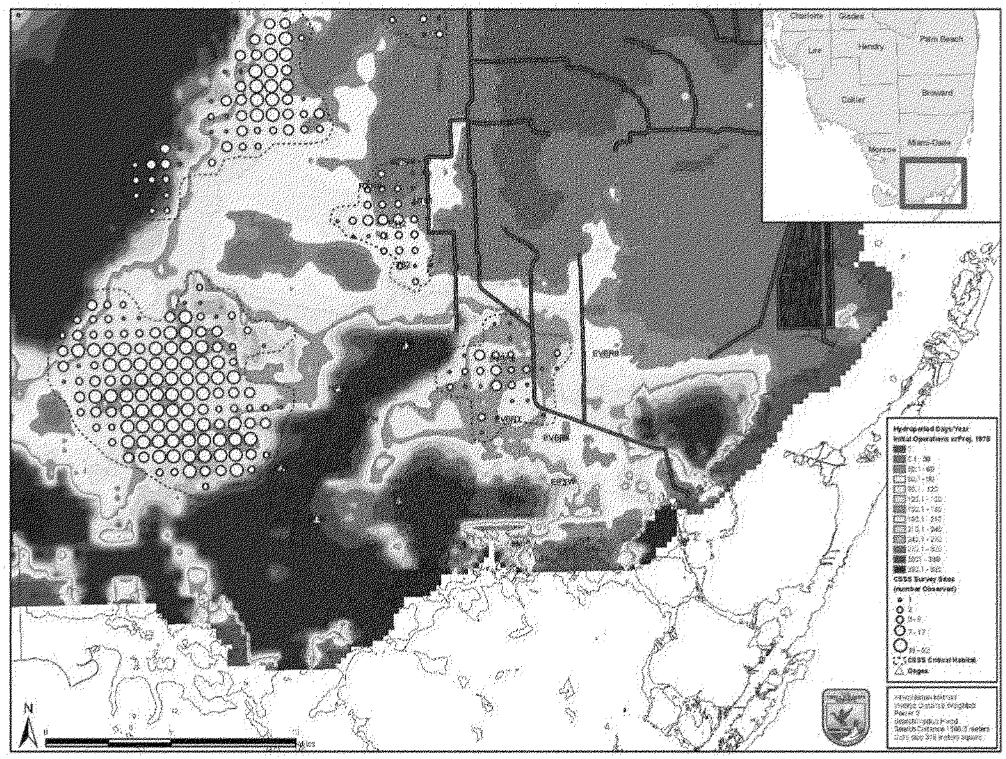


Figure 17. Location of CSSS critical habitat, survey sites, numbers observed, and relationship to C-111 SC Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the initial operations regime (IOR) with the recommended Alternative 2DShort for the modeled year 1978 (average).

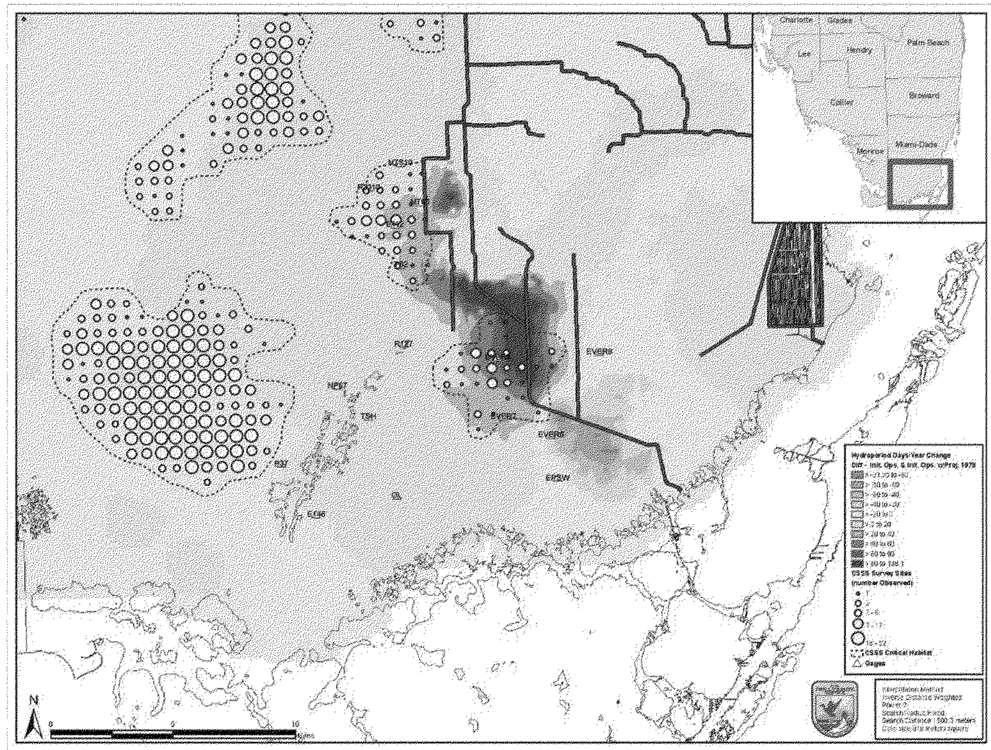


Figure 18. Location of CSSS critical habitat, survey sites, numbers observed, and relationship to C-111 SC Project (Phase 1). Shaded areas show the difference in discontinuous hydroperiod days (water levels above ground) per year between the initial operations regime (IOR) and the IOR with the recommended Alternative 2DShort for the modeled year 1978 (average).

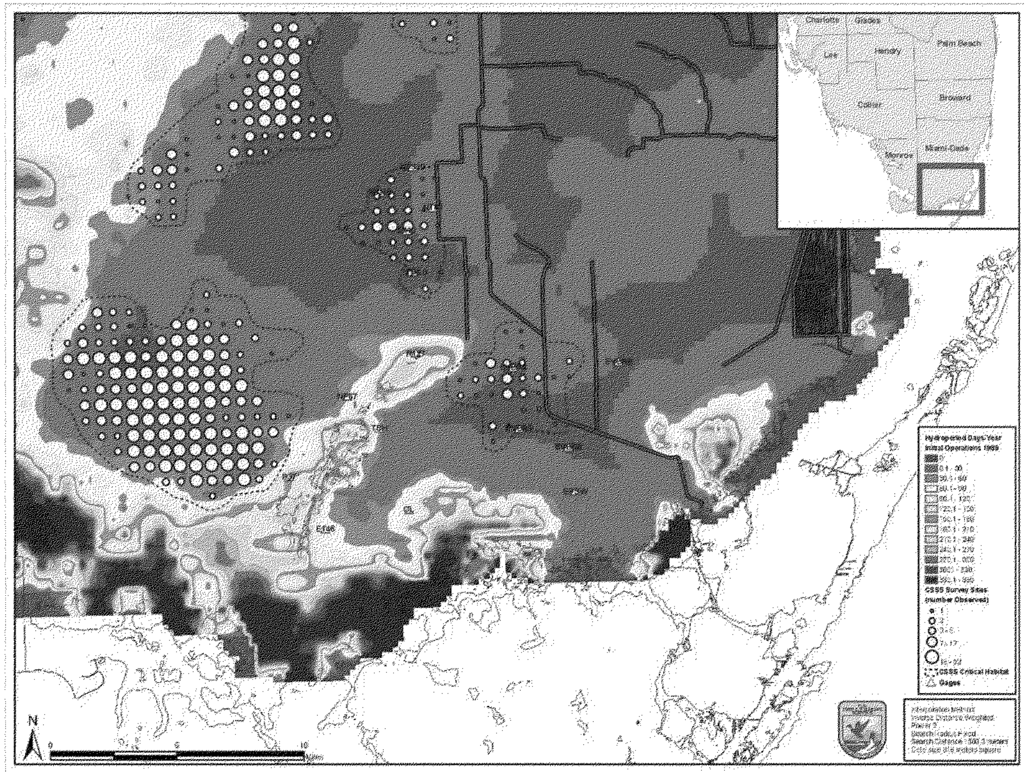


Figure 19. Location of CSSS critical habitat, survey sites, numbers observed, and relationship to C-111 SC Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the initial operations regime (IOR) without the recommended Alternative 2DShort for the modeled year 1989 (dry).

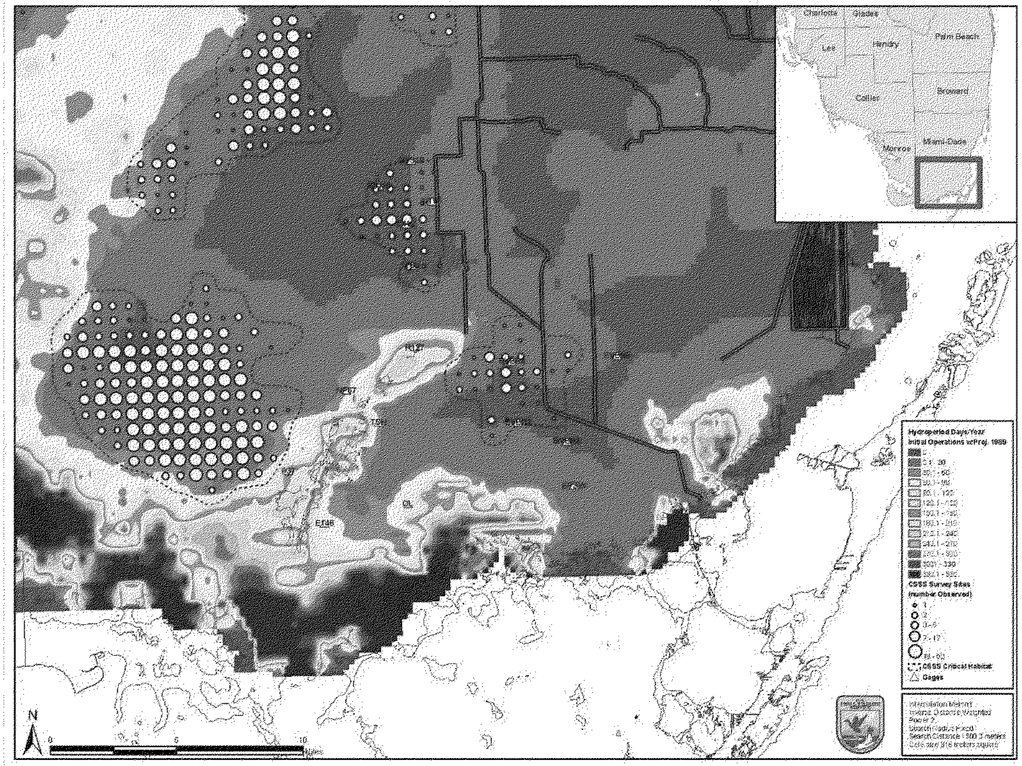


Figure 20. Location of CSSS critical habitat, survey sites, numbers observed, and relationship to C-111 SC Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the initial operations regime (IOR) with the recommended Alternative 2DShort for the modeled year 1989 (dry).

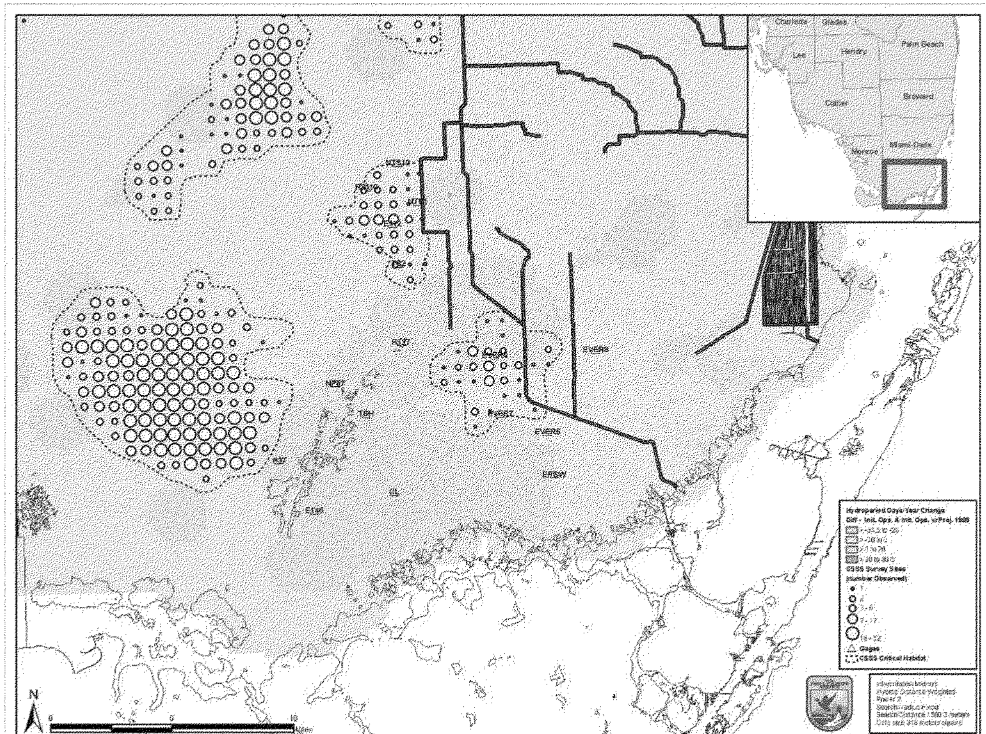


Figure 21. Location of CSSS critical habitat, survey sites, numbers observed, and relationship to C-111 SC Project (Phase 1). Shaded areas show the difference in discontinuous hydroperiod days (water levels above ground) per year between the initial operations regime (IOR) and the IOR with the recommended Alternative 2DShort for the modeled year 1989 (dry).

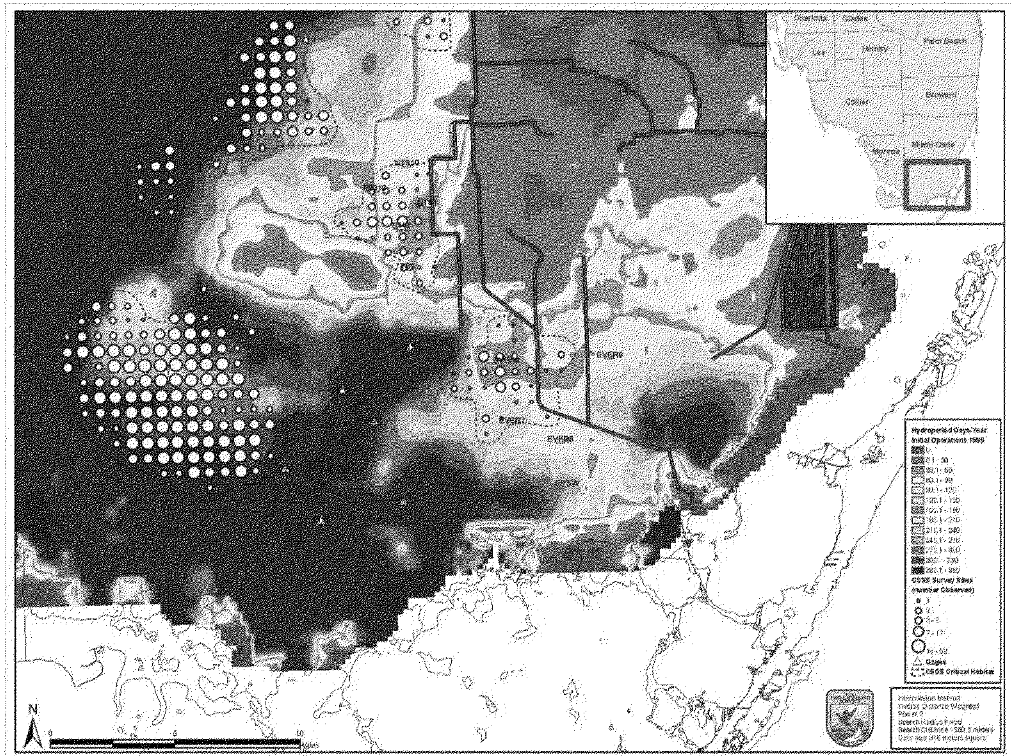


Figure 22. Location of CSSS critical habitat, survey sites, numbers observed, and relationship to C-111SCl Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the initial operations regime (IOR) without the recommended Alternative 2DShort for the modeled year 1995 (wet).

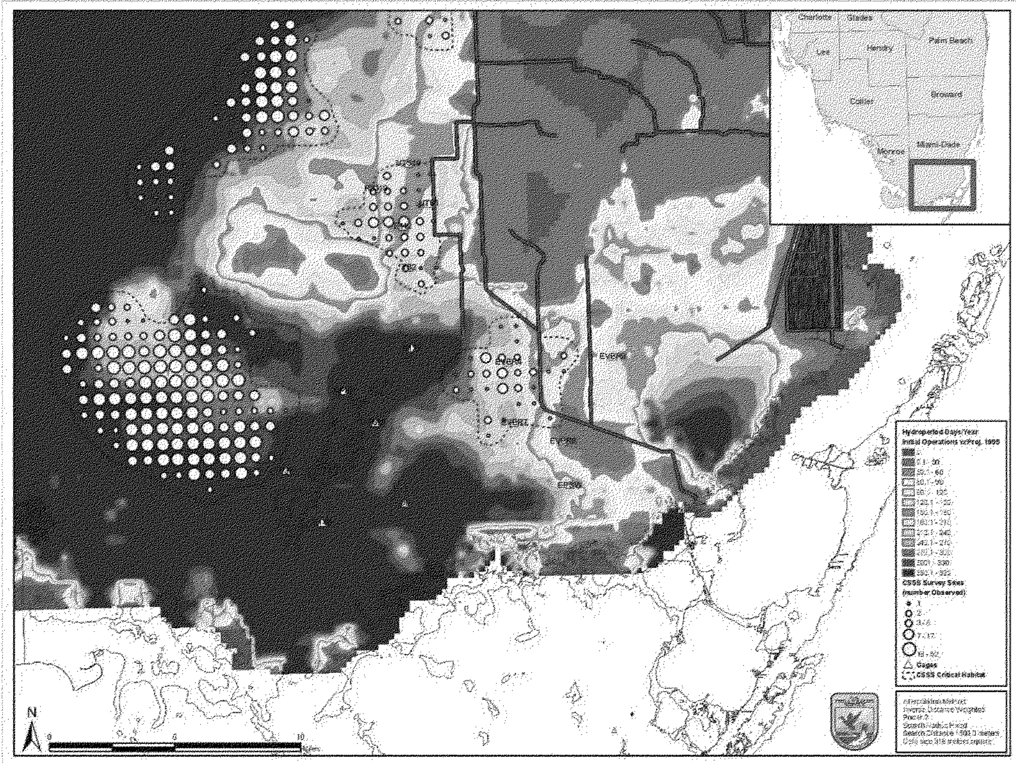


Figure 23. Location of CSSS critical habitat, survey sites, numbers observed, and relationship to C-111S CProject (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the initial operations regime (IOR) with the recommended Alternative 2DShort for the modeled year 1995 (wet).

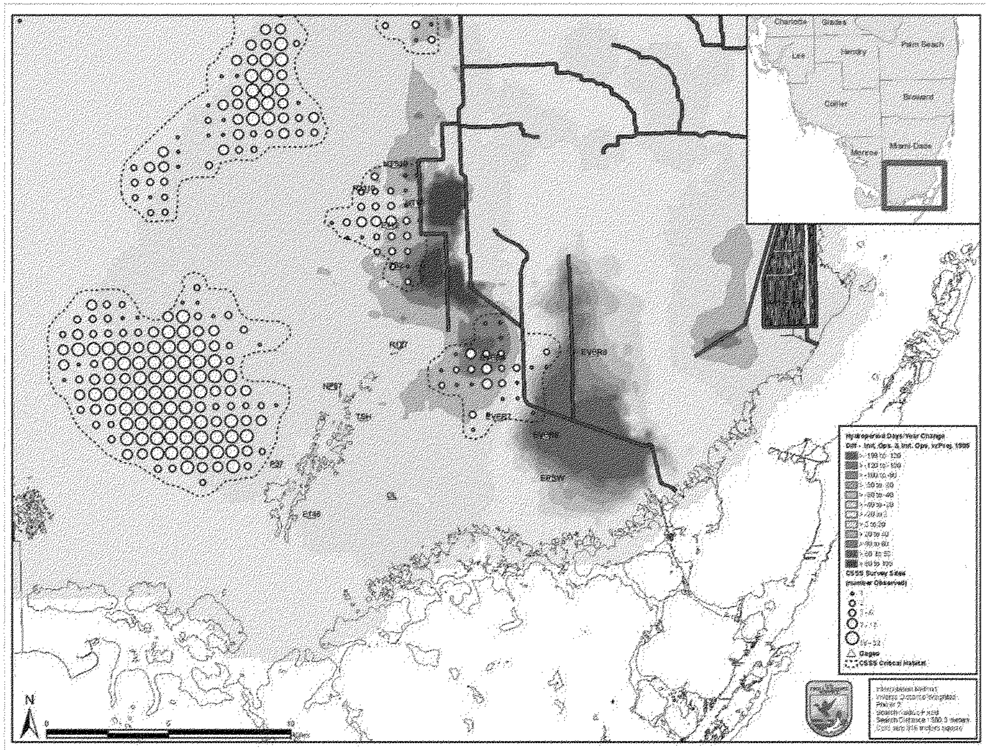


Figure 24. Location of CSSS critical habitat, survey sites, numbers observed, and relationship to C-111SCl Project (Phase 1). Shaded areas show the difference in discontinuous hydroperiod days (water levels above ground) per year between the initial operations regime (IOR) and the IOR with the recommended Alternative 2DShort for the modeled year 1995 (wet).

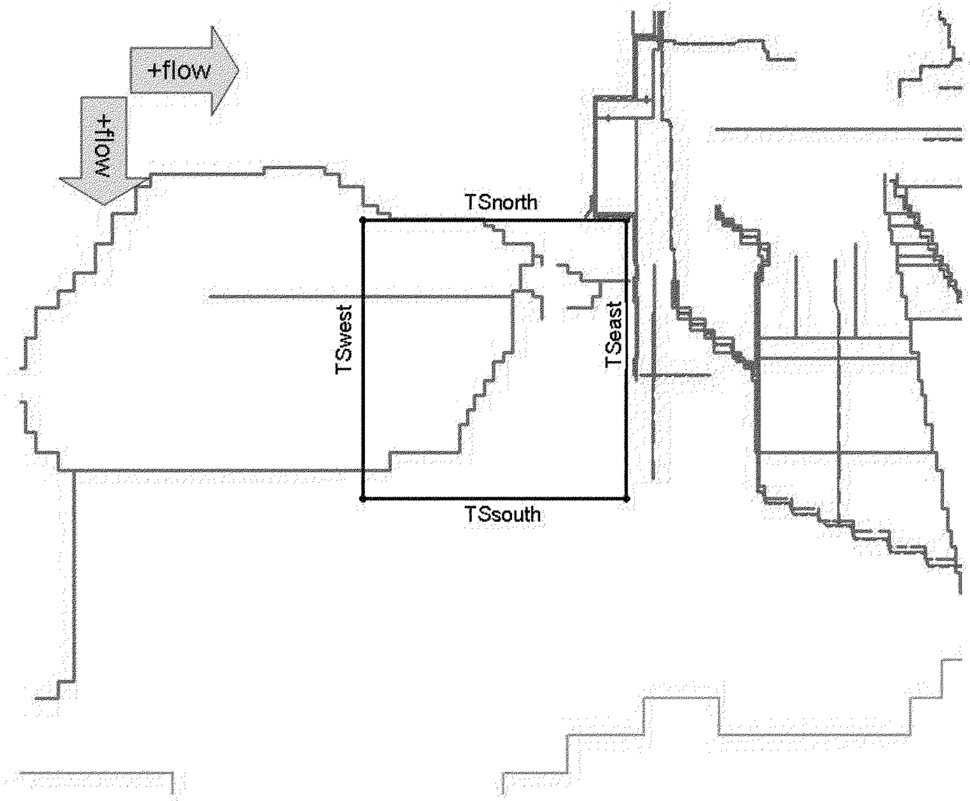


Figure 25. Location of flow transects TS north and TS south across Taylor Slough in relation to project study area features.

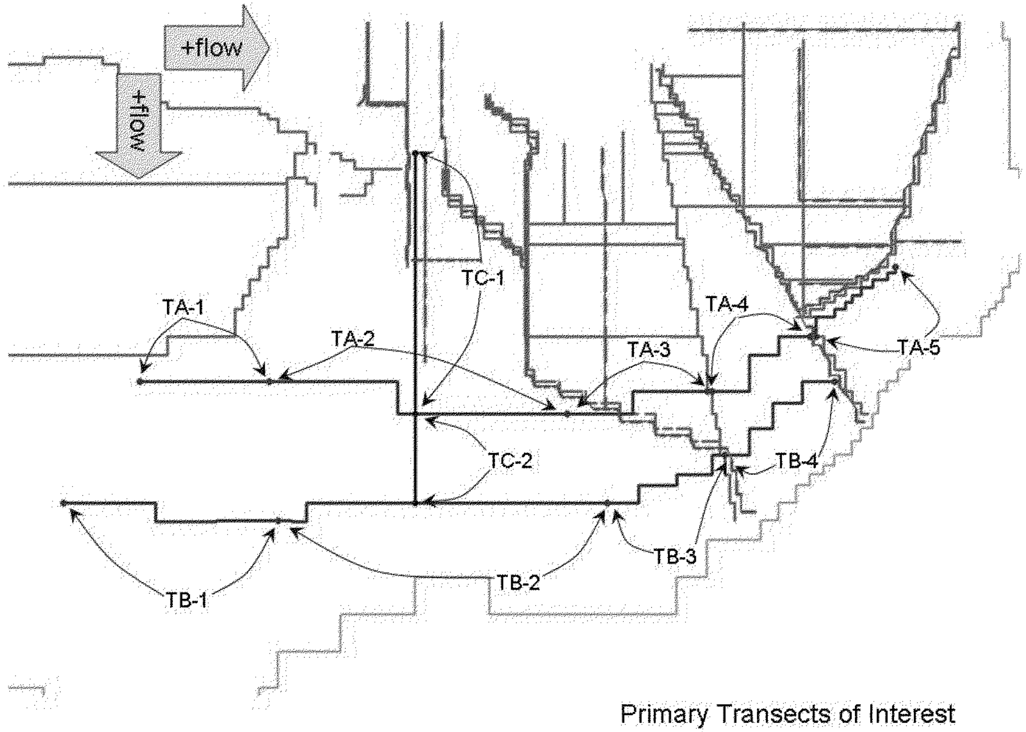


Figure 26. Flow transect locations for transects TA-1, TA-2, TB-1 and TB-2 across Taylor Slough in relation to project study area features.

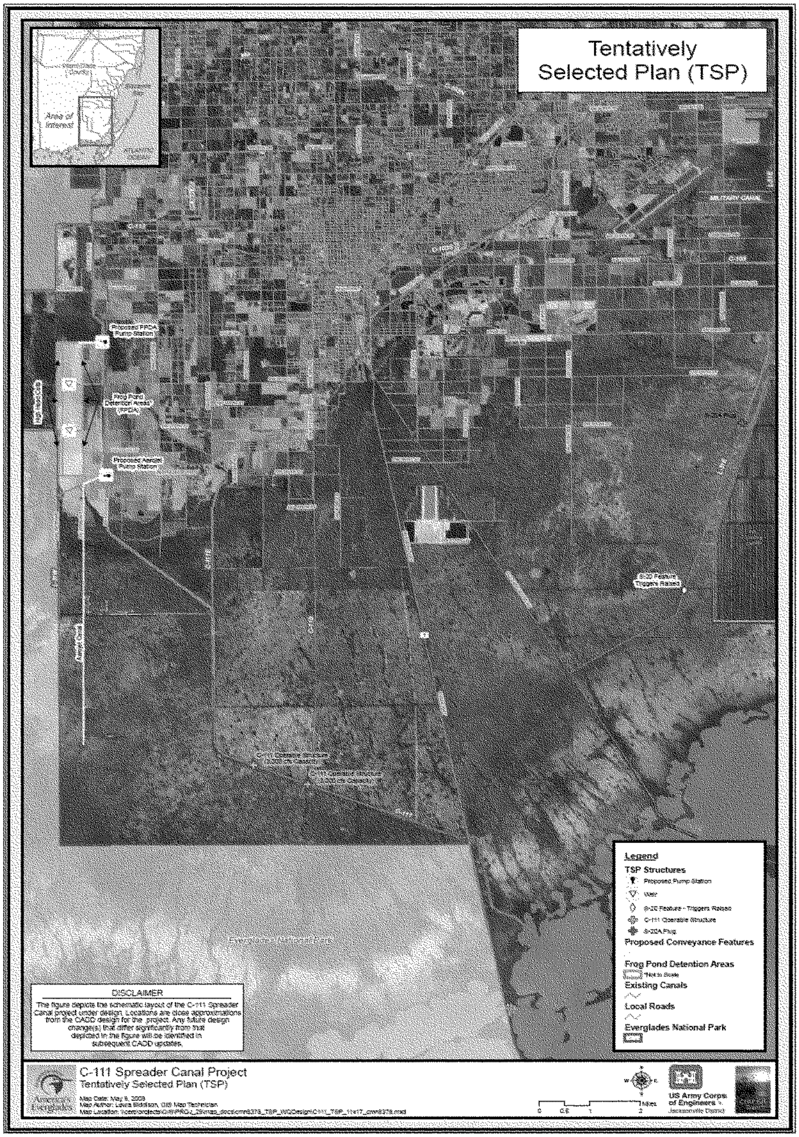


Figure 27. C-111SC Project Phase 1 (Western PIR), project location and components of the recommended, alternative 2DShort.

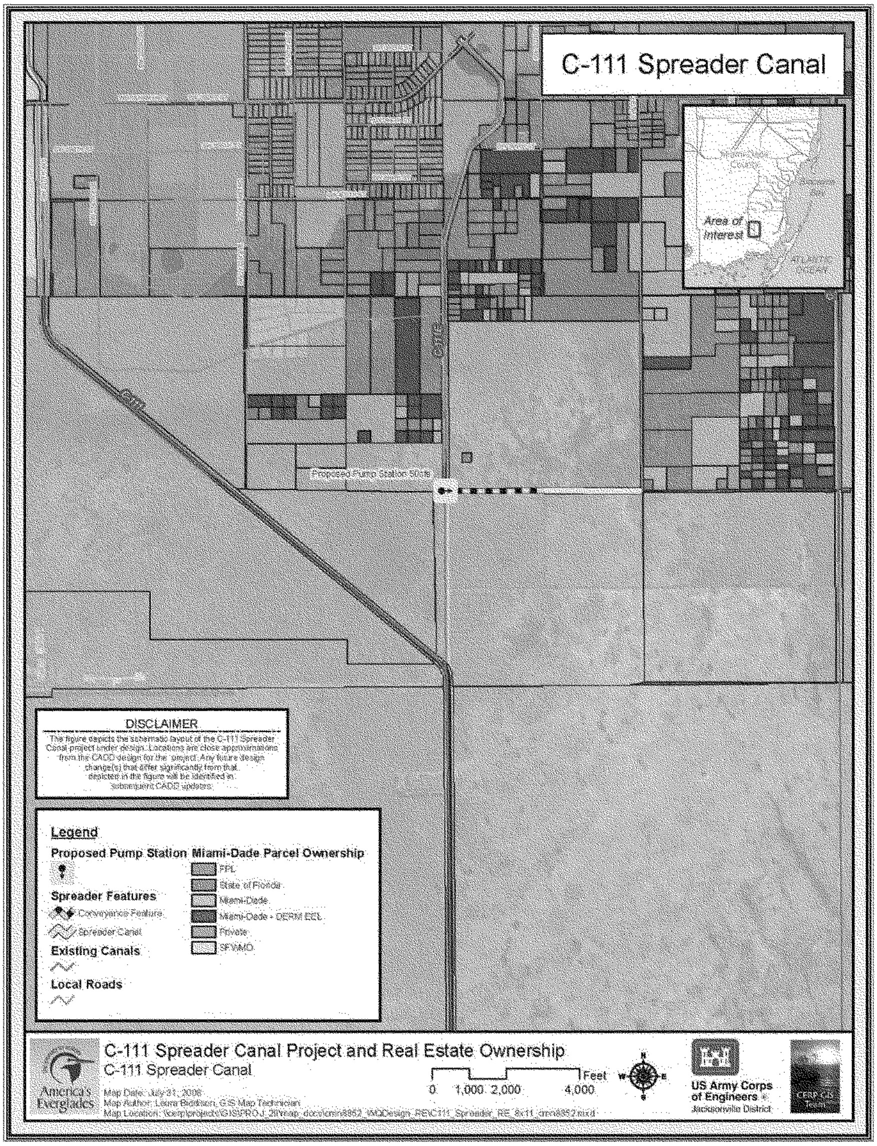


Figure 28. C-111SC Design Test Project location and features.

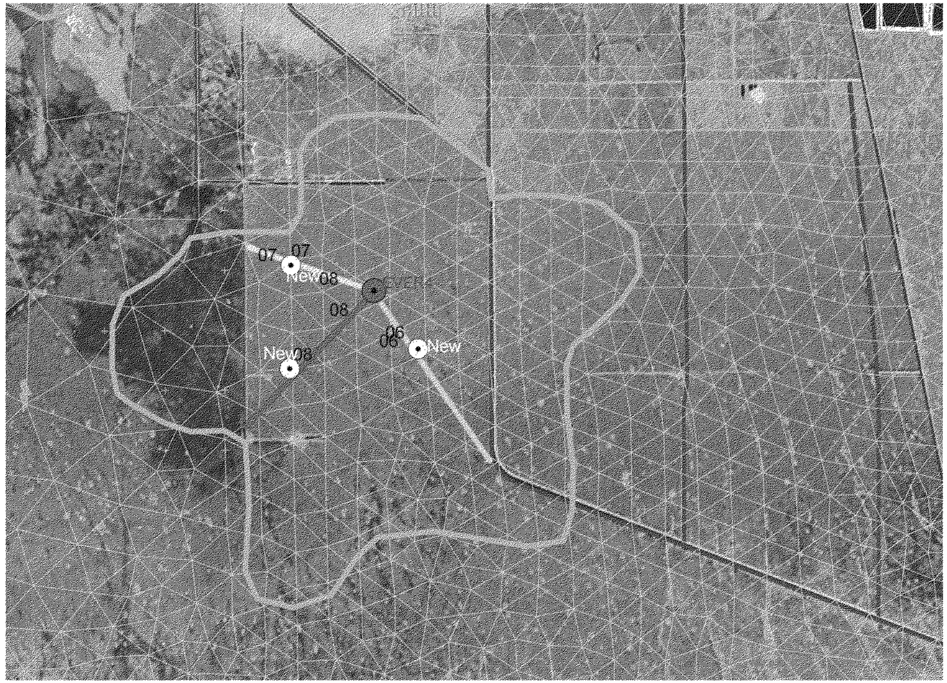


Figure 29. Location of existing (red) and recommended (green) vegetation transects and existing (EVER4) and recommended (white) stage monitoring wellpoints. Numbers (06-08) show locations of CSSS nesting attempts documented by Lockwood et al. 2006 within subpopulation D critical habitat area. CSSS helecopter monitoring grid points (+) and the District's Regional Surface Model cell mesh grid is also shown.

APPENDIX A
Wading Bird Habitat Suitability Index

E.C. 3.2a Wading Bird Habitat Suitability

Model Needs:
Output from the MODBRANCH model will include daily wetland water surface levels for the years (wet, dry, ave.) modeled. This data will be used to evaluate compliance with criterion targets for all model grid cells throughout zones 3-5, for Wading Bird Recession Rates (WBRR), and Wading Bird Foraging Depth (WBFD), for all model runs in units of days and weeks. The output will be a table(s) to show raw output of calculations for number of weeks meeting target, separated by wet-dry-ave. years, model run, subregion, performance score, and average indices.

Calculation Criteria:
WBRR - Dry Season (Nov – Apr) (or at initiation of dry season) Optimal Target: Number of weeks that surface water recession rates (declining depth) range between -5 to - 1.5 cm/week (based on weekly average level) within indicator regions 3, 4, and 5. Secondary Targets: (a.) Number of weeks that surface water recession rates (declining depth) range between -18 to -5 cm/week (based on weekly average level) within indicator regions 3, 4, and 5, (b.) Number of weeks that surface water recession rates (declining depth) range between -1.5 to +1.5 cm/week (based on weekly average level) within indicator regions 3, 4, and 5. Each year (Wet, Dry, Ave.) and subregion will be analyzed separately.

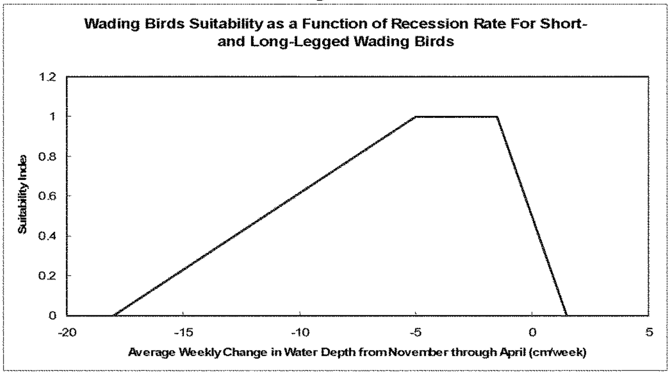
WBFD - Dry Season (Nov – Apr) (or at initiation of dry season). Optimal Target: Dry Season water levels (Nov. – Apr.) range from 0 to 15 cm (based on weekly average level) in Zones 3-5. Secondary Targets: (a.) Dry Season water levels (Nov. – Apr.) range from -3 to 0 cm (based on weekly average level) in Zones 3-5, (b.) Dry Season water levels (Nov. – Apr.) range from 15 to 24 cm (based on weekly average level) in Zones 3-5 The average weekly level will be averaged for all cells within indicator regions 3, 4, and 5. Each year (Wet, Dry, Ave.) and subregion will be analyzed separately.

Calculations:
Note: Stormwater treatment areas, other impoundments, and conveyance structures such as canals and ditches are not considered to be wetlands for the purpose of this performance measure.

<u>Wading Bird Recession Rate (WBRR)</u>
1. Calculate average daily stage (water level) for the first and last day of each week for each cell in the indicator subregion for the period Nov. 1 – Apr. 30 for each year (wet, dry, ave.) analyzed.
2. For each cell in #1, calculate difference in stage between first and last day of week. The average weekly change in water depth ($\Delta_{\text{ave.weekly}}$) from November through April is used to calculate the water recession suitability index (WBRR) for each cell according to the following functions and illustrated in Figure 1.

$SI_{recession} = 0.0$	for $\Delta_{\text{ave.weekly}} \leq -18$ cm or $\Delta_{\text{ave.weekly}} > +1.5$ cm
$SI_{recession} = (\Delta_{\text{ave.weekly}} + 18) / 13.4$	for -18 cm $< \Delta_{\text{ave.weekly}} \leq -5$ cm
$SI_{recession} = 1.0$	for -5 cm $< \Delta_{\text{ave.weekly}} \leq -1.5$ cm
$SI_{recession} = (0.5 - (\Delta_{\text{ave.weekly}} / 3))$	for -1.5 cm $< \Delta_{\text{ave.weekly}} \leq 1.5$ cm

Figure 1

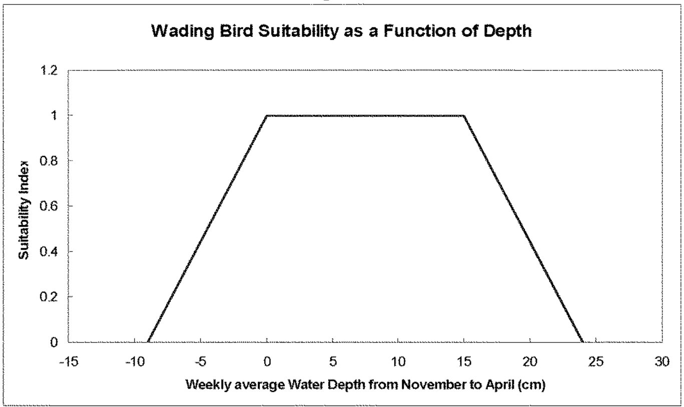


<u>Wading Bird Foraging Depth (WBFD)</u>

1. Calculate average weekly stage (water level) for each cell in the subregions for the period Nov. 1 – Apr. 30 for each year (wet, dry, ave.) analyzed.
2. For each cell in #1, the ave. weekly depth (d) from November through April is used to calculate the suitability index for water depth (WBFD) according to the following functions and illustrated in Figure 2.

$SI_{depth} = 0.0$	for $d \leq -9$ cm or $d > 24$ cm
$SI_{depth} = (d / 9) + 1$	for -9 cm $< d \leq 0$ cm
$SI_{depth} = 1.0$	for $0 < d \leq 15$ cm
$SI_{depth} = -0.11\,(d) + 2.65$	for 15 cm $< d \leq 24$ cm

Figure 2



Wading Bird Suitability Index (WBSI)

The WBRR and WBFD indices for each cell obtained from steps (2) above are then used to calculate WBSI. The combined wading bird suitability index for each cell at each weekly time step is calculated as the minimum of the suitability indices for either recession rate (WBRR) or water depth (WBFD) scores for each cell:

WBSI = min(WBFD, WBRR)

Group this weekly WBSI by cell data for each subregion (3A-5D,TS) but continuing to separate wet, dry, and ave. years analysis.

Wading Bird Habitat Suitability (WBHS)
To capture the landscape level wading bird habitat suitability (WBHS), the mean suitability score of the individual cell WBSI scores for the top 23 percent of cells in each subregion is calculated each week. Twenty-three percent was chosen because studies have shown that approximately one-quarter of cells (or habitat) are occupied at any one time by feeding wading birds during a good nesting year (Gawlik et al. 2004, Bancroft et al. 1995).

WBHS = mean(top 23% WBSI for each subregion)

Habitat Units
Sum the acreage of all the cells (top 23 percent each week) used to calculate the weekly WBHS above. This total acreage of all cells for each week is multiplied by the mean weekly WBHS score to obtain habitat units for project alternative evaluation during the benefits analysis along with data from other performance measures.

HU = ∑ (cell acreage of top 23% WBHS scores by subregion) X (mean weekly WBHS score by subregion)

Bancroft, G.T., A.M. Strong., R.J. Sawicki, W. Hoffman, and S.D. Jewell, 1995. Relationships Among Wading Bird Foraging Patterns, Colony Locations, and Hydrology in the Everglades. In: *Everglades: The Ecosystem and It's Restoration*, S. M. Davis and J.C. Ogden (Eds.), 1995. St. Lucie Press, Delray Beach, Fla. Chap. 25.

Gawlik, D.E., G. Crozier, and K.C. Tarboton, 2004. Wading Bird Habitat Suitability Index. In: *Habitat Suitability Indices for Evaluating Water Management Alternatives,* K.C. Tarboten, M.M. Irizarry-Ortiz, D.P. Loucks, S.M. Davis, and J.T. Obeysekera (Eds.), 2004. Office of Modeling Technical Report, South Florida Water Management District, West Palm Beach, Fla. Chap. 8.

APPENDIX B
Snail Kite Survey Protocol

South Florida Ecological Services Office
DRAFT
May 18, 2004

Snail Kite Survey Protocol

A survey is necessary when the project site is within the snail kite consultation area and suitable habitat is present. The following criteria can be used to judge the adequacy of the habitat for snail kites.

1. Appropriate foraging habitat present
   [paspalidum (*Paspalidium geminatum*), spikerushes (*Eleocharis* spp.), panicum (*Panicum* spp.), or beakrushes (*Rhynchospora* spp.)].
2. Nesting or perching substrate present
   [willows (*Salix caroliniana*), melaleuca (*Melaleuca quinquenervia*), or pond cypress (*Taxodium ascendens*)]
   [sawgrass (*Cladium jamaicense*), cattail (*Typha* spp.), giant bulrush (*Scirpus validus*), or reed (*Phragmites australis*)].
3. Appropriate water depth (0.2-1.3 m deep) under nesting substrate.
4. Nesting substrate an adequate distance (>150 m) from upland.
5. Proximity of nearest wading bird colony.

If suitable habitat is present or snail kites are reported on site the following survey procedures should be used to document their occurrence. To maximize the chances of finding snail kites the survey should be conducted in January to May during the breeding season.

Record conditions in the suitable habitat including emergent vegetation types, nesting and perching substrate types, water depth in potential nesting areas, and distance from uplands.

A visual survey of suitable habitat should be made for birds and nests. A boat may be needed for the survey as the best nesting habitat may be a considerable distance (>150 m) from uplands. Check small trees, such as, willow, melaleuca, and pond cypress along the open water edge for nests or perching birds. If snail kites are observed, then nests can be located through the bird's behavior. When flushed from a nest the adult tends to circle upward, whereas non-nesting birds that are flushed fly more horizontally away from the disturbance (Bennetts et al. 1988). Nests also can be found by following kites carrying sticks, adults carrying apple snails, aerial courtship displays, vocalizations of adults or begging calls of the young, and through a thorough search of areas where adults are repeatedly observed (Bennetts et al. 1988).

When water levels are low snail kites may be forced to nest in vegetation along levees and roads. Check herbaceous vegetation, such as sawgrass, cattail, bulrush, and reed for nests. Record the location of all snail kites observed and describe their behavior. If nests are observed estimate the position of the nest (boat geographic position with direction and distance to nest) without approaching any closer than needed to reduce disturbance to the birds. Plot the location of nests on a map of the site.

Snail kites are highly gregarious and typically roost in colonies when not breeding. Birds found on perches that do not return to a nest site are most likely non-breeding. Follow these birds 1.5 to 2 hours before dusk to their roost location (Sykes 1982). Especially look for snail kites around sites with wading birds colonies (*e.g.*, anhingas and herons) nearby. Record the roost location, vegetation types, and number of snail kites at the site.

Where project activities, such as dredging, brush clearing, and herbicide treatment, may come within 130 m (425 ft) of nest or roost sites the area can be marked with PVC poles or poles with white balls on the top if aerial observation is necessary. The geographic coordinates of the markers should be obtained and marked on a site map. Project personnel should be informed to avoid marked areas and given a map indicating protective areas.

Because of the secretive nature of the snail kite and the need to differentiate breeding and non-breeding behavior surveys require specialized training. A qualified avian biologist/ecologist should be used to be to obtain acceptable results.

South Florida Ecological Services Office
DRAFT
May 18, 2004

Snail Kite Monitoring Protocol

Every effort should be undertaken to avoid adverse effects to any snail kite observed during project activities. If it appears that these activities will alter breeding, feeding, or roosting behavior of snail kites, the activity must not be carried out until the proper action can be determined.

A pre-project activity survey should be conducted to learn foraging, feeding, and roosting patterns of the snail kite group on site. Document the location of all snail kites and describe their behavior.

Once project activities begin a monitor should be on site if activities are within 130 m (425 ft) of snail kite nests or roosts. Project activities should cease if the snail kites are disturbed. If disturbance is expected then an incidental take permit is needed.

At the end of project activities in the snail kite areas a monitoring report should be sent to the South Florida Ecological Services Office within 60 days.

A snail kite education plan can be used to help reduce the effects of a project on snail kites. All project associated personnel should be briefed as to the nature of snail kites and the potential impacts of the project on them. The plan should include:

1. a description of the snail kite, its habits, and protection under Federal law;

2. instruction not to injure, harm, harass, or kill this species or possess any part thereof (*e.g.*, feathers, eggs, and nest);

3. instructions to cease project activities if a snail kite nest or roost is found with 130 m (425 ft) of project activities; and

4. telephone numbers of pertinent agencies to contact if snail kite is found dead.

If an on-site monitor is needed they should have the following qualifications:

a qualified avian biologist/ecologist;

demonstrate their familiarity with south Florida raptor species and have prior south Florida raptor survey and monitoring observational experience; and

have authority to cease all project related activities that may appear to alter breeding, feeding, or roosting behavior of snail kites.

Activities can resume if the birds leave the area or when the nestlings have fledged.

Literature Cited

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APPENDIX C
Draft Snail Kite Management Guidelines

U.S. Fish and Wildlife Service

Draft Snail Kite Management Guidelines
February 21, 2006

These guidelines were developed to help resource managers and other interested parties avoid detrimental impacts to endangered Everglade snail kites and their habitat, and to provide information that will allow managers to improve conditions for snail kites. Everglade snail kites are listed as endangered under Federal and Florida State laws. Any disturbance to snail kites or their nests, including flushing perched birds, interrupting foraging, flushing adults from nest sites, interfering with feeding and protection of nestling kites, and impacting vegetation that supports kite nests is prohibited. Adherence to these guidelines will minimize the likelihood that actions result in prohibited impacts to snail kites. If you see snail kites, we always recommend that you simply avoid the immediate area where kites are present. If in doubt about whether an activity may affect kites, please contact a U.S. fish and Wildlife Service (Service) or Florida Fish and Wildlife Conservation Commission (FWC) office.

MINIMIZING IMPACTS TO KITE NESTING DURING BREEDING SEASON

During each nesting season (generally December 1 to July 31, but including all periods when active nests are known), locations of all known snail kite nests will be provided to the Service from researchers and resource managers, and then distributed to appropriate agency representatives. Maps and coordinates of nest sites, kite protection buffers, and priority kite management zones will be distributed to established points of contact for agencies and organizations that conduct management actions in kite habitat. These points of contact will be responsible for disseminating the information to personnel working on the ground.

Nest Protection Buffers

Two buffer zones will be established around every active snail kite nest. This includes all nests reported to the Service by researchers and any unreported nest that is encountered during other activities. These buffer zones will be in effect from when kites begin nest building through the time when breeding activity is no longer observed at the site. Because kites can renest, and often renest in the same area as previous attempts, buffer zones may remain in place past the time when fledglings leave the area if adult kites continue to show breeding activity, including courtship, in the general area. Kites do not exhibit fidelity to a specific nest site from year to year. Consequently, all restrictions within these buffer zones will be lifted once breeding activity has ceased.

1. No-entry Buffer Zones - A 500-foot (ft) (~150 meter) radius no-entry buffer zone will be established around all active nests that are discovered. The purpose of this buffer zone is to protect kites from direct disturbance that may affect the fate of nesting.

- Airboats, personnel, helicopters, and other equipment and activity must stay outside of these areas at all times when kite breeding activity is occurring.
- These buffers are slightly larger than the estimate of 430 ft (131 m) recommended in a study of disturbance to birds from airboats (Rodgers and Schwikert 2003). This larger buffer was selected because the disturbance tested in their study does not necessarily represent the types of activity that may occur during land management activities because they monitored the responses of perched birds and not nesting birds.

2. Limited Activity Buffer Zones - A 1,640 ft (500 meter) radius limited-activity buffer zone will be established around all active kite nests. This buffer zone is intended to maintain and protect foraging opportunities and habitat conditions around each nest to allow the nest to succeed. The goal is to maintain habitat conditions for the entire nesting period similar to those that were present when the birds selected the site.

- Airboats, personnel, helicopters, and other equipment and activity should stay outside of this buffer when possible, and activity within the buffer should be limited to the minimum time necessary to complete appropriate management activities.
- Only management activities that are expected to maintain or improve the existing kite foraging and nesting habitat within these areas should occur while there is evidence of kite breeding activity.
    - Exotic and invasive plant control efforts, including water hyacinth, water lettuce, and hydrilla, and similar invasive species that may rapidly encroach on native vegetation communities may be treated within limited-activity buffer zones during kite breeding, so long as treatments are not expected to result in impacts to vegetation species that contribute to snail kite and apple snail habitat. Treatments expected to result in changes > 10 percent in the cover or occurrence of native vegetation species including spike rushes, bulrushes, maidencane, and other emergent vegetation should be avoided.
    - Treatments of invasive and undesirable woody plants, cattails, tussocks, and other similar vegetation should not occur within these buffer zones during kite nesting. These treatments should be postponed until after kite breeding activity has ceased.
    - These buffer distances are intended to encompass the primary foraging area around a nest. The buffer distance is larger than the 820 ft (250 meter) radius recommended by Sykes (1987), and is a better representation of the area that kites use for foraging during nesting.

<u>**Priority Kite Management Areas**</u>

Snail kite nesting does not occur randomly within wetland systems. Instead, there are generally areas within wetlands, where kite nesting is concentrated. The density of kite nests, frequency of nesting within each area, and the sizes of these “priority kite nesting areas” are highly variable, but identifying these areas may help resource managers to focus management actions. In most years, the majority of kite nesting will occur within these areas, though new nesting areas may become active. At the end of each nesting season, primary kite nesting areas will be delineated based on the current year’s nest locations and nesting in the previous 10 years.

- The polygons that delineate priority kite nesting areas, are ‘kernels’ that represent the 90 percent probability density function for kite nests over a 10-year period (1996-2005 in this case). These polygons were delineated under the assumption that the density of kite nests over the past 10 years indicates the likelihood of future kite nesting, and approximately 90 percent of the kite nesting, on average, will occur within these polygons if patterns of nest site selection continue as in the past.
- These areas will be provided to agency representatives soon after the end of the kite breeding season (July), and represent areas where resource management activities are likely to be limited due to kite nesting activity. Proposed management actions should incorporate pre-treatment kite surveys, or avoid these areas during the early part of the following breeding season (from January 1 to May 31) when kites are selecting nesting

sites. These also represent the areas where proactive management for snail kite foraging habitat may be most beneficial.

- This information will be provided (in most years) several months prior to the beginning of the kite breeding season to allow land managers to avoid impacts to kite nesting through early planning by timing proposed treatments in these areas to avoid critical periods for kites.
- The extent of these areas will generally not change dramatically from year-to-year.
- Management actions do not have to be excluded from these areas during the entire nesting season, but surveys for kite nesting activity should be conducted prior to working in these areas during the kite nesting season, and avoiding work in these areas during the breeding season is recommended whenever possible.
- There is good potential for kite nesting to occur outside of these areas, and resource managers should always look for evidence of snail kites and kite breeding activity prior to conducting management actions.

MANAGING FOR SNAIL KITE HABITAT

Active management of wetlands to benefit snail kites has not been regularly conducted. However, there are several actions and considerations that resource managers can adopt that may benefit snail kites.

- Foraging habitat – maintaining Florida apple snail populations, and the vegetation types that support healthy Florida apple snail populations is critically important to maintaining snail kite habitat. Not all areas where there are abundant apple snails support snail kite nesting, but most of these areas provide foraging habitat for snail kites at some time.
    - Shallow wetlands with emergent vegetation such as spike rush, bulrush, and other native emergent wetland plant species provide good snail kite foraging habitat as long as the vegetation is not so dense that kites would have difficulty locating apple snails. The specific conditions and vegetation species that provide good snail kite foraging habitat vary depending on the specific conditions of each wetland (lake or marsh, variability in water depths, soil characteristics, etc.).
    - Control of exotic and invasive plant species such as water hyacinth and water lettuce may be necessary to maintain the open character of vegetation within kite foraging habitat.
    - Non-native species of apple snails may provide forage for snail kites. However, initial evidence suggests that these species are not consistent with maintaining sustainable wetland communities. Maintaining a healthy population of Florida's native apple snail, and working to control non-native snail species is a more sustainable management strategy.
- Nesting habitat – kites are not particularly discriminating about their nest sites, and they may nest in a wide variety of substrates and situations. However, kite nests are generally most successful in low woody species such as willow, buttonbush, pond apple, and other wetland shrubs that remain inundated for the entire nesting period, and efforts to maintain or produce favorable nesting sites may help maintain kite nesting.
    - Planting woody wetland species in areas that support snail kite foraging habitat and do not dry out completely during the kite breeding season may facilitate snail kite nesting and nest success. Any planted woody vegetation should be managed for long-term persistence.

  - Nests that occur in dense cattails, bulrush, and other herbaceous species are more vulnerable to collapse than those in woody substrates.
  - Potential nesting areas that dry out during the nesting period are vulnerable to land-based predators such as raccoons.
  - Nesting areas are almost always located within areas of good foraging habitat.
  - Invasive and exotic woody vegetation may be used by snail kites as nesting substrate, but these species are not components of sustainable snail kite habitat. Controlling invasive and exotic woody vegetation outside of snail kite nesting season, and replanting with native wetland woody plant species where needed will be a more effective long-term strategy for managing snail kite nesting habitat.
- Managing hydroperiod – Changes in water regimes and depth and duration of inundation are important characteristics for wetland vegetation that supports snail kite nesting and foraging habitat, Florida apple snails, and all aspects of snail kite and apple snail life history.
  - Continuous inundation and stabilized water levels for long periods will probably result in unfavorable vegetation conditions.
  - Long periods of drying (> 1-2 months) will detrimentally affect Florida apple snail populations, and reduce the likelihood of use by snail kites. However, occasional drying for shorter periods may be beneficial.
  - Rapid changes and large changes in the depth of water within wetlands have the potential to detrimentally affect kite nesting and apple snail populations.
    - Rapid and/or large drops in water level increase the risk of snail kite nest predation by drying out the substrate beneath nests and allowing land-based predators to access nests.
    - Rapid and/or large increases in water depth may detrimentally affect desirable vegetation, and can flood out Florida apple snail eggs, leading to reductions in apple snail populations and reduced snail kite foraging.

COMMENTS, FEEDBACK, AND NEW INFORMATION

We always request feedback, new information, and recommendations for improving guidelines and snail kite management from resource managers and on-the-ground crews.

- We request that individuals report snail kite nesting activity outside of documented nesting areas.
- We welcome questions about managing snail kites, snail kite habitat, and apple snail populations.
- Additional information about snail kites and their habitat can be found at the Service's South Florida Ecological Services Office web site at: http://www.fws.gov/verobeach/index.htm
- Questions, comments, and inquiries can be directed to Tylan Dean by e-mailing: Tylan_Dean@fws.gov, or by calling (772) 562-3909, extension 284.

LITERATURE CITED

Rodgers, J.A. Jr. and S.T. Schwikert. 2003. Buffer zone distances to protect foraging and loafing waterbirds from disturbance by airboats in Florida. Waterbirds 26(4):437-443.

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APPENDIX D
Habitat Management Guidelines for Wood Storks in the SE Region

HABITAT MANAGEMENT GUIDELINES FOR THE WOOD STORK IN THE SOUTHEAST REGION

HABITAT MANAGEMENT GUIDELINES FOR THE WOOD STORK IN THE SOUTHEAST REGION

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HABITAT MANAGEMENT GUIDELINES FOR THE WOOD STORK IN THE SOUTHEAST REGION

Introduction

A number of Federal and state laws and/or regulations prohibit, cumulatively, such acts as harrassing, disturbing, harming, molesting, pursuing, etc., wood storks, or destroying their nests (see Section VII). Although advisory in nature, these guidelines represent a biological interpretation of what would constitute violations of one or more of such prohibited acts. Their purpose is to mainain and/or improve the environmental conditions that are required for the survival and well-being of wood storks in the southeastern United States, and are designed essentially for application in wood stork/human activity conflicts (principally land development and human intrusion into stork use sites). The emphasis is to avoid or minimize detrimental human-related impacts on wood storks. These guidelines were prepared in consultations with state wildlife agencies and wood stork experts in the four southeastern states where the wood stork is listed as Endangered (Alabama, Florida, Georgia, South Carolina).

General

The wood stork is a gregarious species, which nests in colonies (rookeries), and roosts and feeds in flocks, often in association with other species of long-legged water birds. Storks that nest in the southeastern United States appear to represent a distinct population, separate from the nearest breeding population in Mexico. Storks in the southeastern U.S. population have recently (since 1980) nested in colonies scattered throughout Florida, and at several central-southern Georgia and coastal South Carolina sites. Banded and color-marked storks from central and southern Florida colonies have dispersed during non-breeding seasons as far north as southern Georgia, and the coastal counties in South Carolina and southeastern North Carolina, and as far west as central Alabama and northeastern Mississippi. Storks from a colony in south-central Georgia have wintered between southern Georgia and southern Florida. This U.S. nesting population of wood storks was listed as endangered by the U.S. Fish and Wildlife Service on February 28, 1984 (*Federal Register* 49(4):7332-7335).

Wood storks use freshwater and estuarine wetlands as feeding, nesting, and roosting sites. Although storks are not habitat specialists, their needs are exacting enough, and available habitat is limited enough, so that nesting success and the size of regional populations are closely regulated by year-to-year differences in the quality and quantity of suitable habitat. Storks are especially sensitive to environmental conditions at feeding sites; thus, birds may fly relatively long distances either daily or between regions annually, seeking adequate food resources.

All available evidence suggests that regional declines in wood stork numbers have been largely due to the loss or degradation of essential wetland habitat. An understanding of the qualities of good stork habitat should help to focus protection efforts on those sites that are seasonally important to regional populations of wood storks. Characteristics of feeding, nesting, and roosting habitat, and management guidelines for each, are presented here by habitat type.

I. Feeding habitat.

A major reason for the wood stork decline has been the loss and degredation of feeding habitat. Storks are especially sensitive to any manipulation of a wetland site that results in either reduced amounts or changes in the timing of food availability.

Storks feed primarily (often almost exclusively) on small fish between 1 and 8 inches in length. Successful foraging sites are those where the water is between 2 and 15 inches deep. Good feeding conditions usually occur where water is relatively calm and uncluttered by dense thickets of aquatic vegetation. Often a dropping water level is necessary to concentrate fish at suitable densities. Conversely, a rise in water, especially when it occurs abruptly, disperses fish and reduces the value of a site as feeding habitat.

The types of wetland sites that provide good feeding conditions for storks include: drying marshes or stock ponds, shallow roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, and depressions in cypress heads or swamp sloughs. In fact, almost any shallow wetland depression where fish tend to become concentrated, either through local reproduction or the consequences of area drying, may be used by storks.

Nesting wood storks do most of their feeding in wetlands between 5 and 40 miles from the colony, and occasionally at distances as great as 75 miles. Within this colony foraging range and for the 110-150 day life of the colony, and depending on the size of the colony and the nature of the surrounding wetlands, anywhere from 50 to 200 different feeding sites may be used during the breeding season.

Non-breeding storks are free to travel much greater distances and remain in a region only for as long as sufficient food is available. Whether used by breeders or non-breeders, any single feeding site may at one time have small or large numbers of storks (1 to 100+), and be used for one to many days, depending on the quality and quantity of available food. Obviously, feeding sites used by relatively large numbers of storks, and/or frequently used areas, potentially are the more important sites necessary for the maintenance of a regional population of birds.

Differences between years in the seasonal distribution and amount of rainfall usually mean that storks will differ between years in where and when they feed. Successful nesting colonies are those that have a large number of feeding site options, including sites that may be suitable only in years of rainfall extremes. To maintain the wide range of feeding site options requires that many different wetlands, with both relatively short and long annual hydroperiods, be preserved. For example, protecting only the larger wetlands, or those with longer annual hydroperiods, will result in the eventual loss of smaller, seemingly less important wetlands. However, these small scale wetlands are crucial as the only available feeding sites during the wetter periods when the larger habitats are too deeply flooded to be used by storks.

II. Nesting habitat.

Wood storks nest in colonies, and will return to the same colony site for many years so long as that site and surrounding feeding habitat continue to supply the needs of the birds. Storks require between 110 and 150 days for the annual nesting cycle, from the period of courtship until the nestlings become independent. Nesting activity may begin as early as December or as late as March in southern Florida colonies, and between late February and April in colonies located between central Florida and South Carolina. Thus, full term colonies may be active until June-July in south Florida, and as late as July-August at more northern sites. Colony sites may also be used for roosting by storks during other times of the year.

Almost all recent nesting colonies in the southeastern U.S. have been located either in woody vegetation over standing water, or on islands surrounded by broad expanses of open water. The most dominant vegetation in swamp colonies has been cypress, although storks also nest in swamp hardwoods and willows. Nests in island colonies may be in more diverse vegetation, including mangroves (coastal), exotic species such as Australian pine (*Casuarina*) and Brazilian Pepper (*Schinus*), or in low thickets of cactus (*Opuntia*). Nests are usually located 15-75 feet above ground, but may be much lower, especially on island sites when vegetation is low.

Since at least the early 1970's, many colonies in the southeastern U.S. have been located in swamps where water has been impounded due to the construction of levees or roadways. Storks have also nested in dead and dying trees in flooded phosphate surface mines, or in low, woody vegetation on mounded, dredge islands. The use of these altered wetlands or completely "artificial" sites suggests that in some regions or years storks are unable to locate natural nesting habitat that is adequately flooded during the normal breeding season. The readiness with which storks will utilize water impoundments for nesting also suggests that colony sites could be intentionally created and maintained through long-term site management plans. Almost all impoundment sites used by storks become suitable for nesting only fortuitously, and therefore, these sites often do not remain available to storks for many years.

In addition to the irreversible impacts of drainage and destruction of nesting habitat, the greatest threats to colony sites are from human disturbance and predation. Nesting storks show some variation in the levels of human activity they will tolerate near a colony. In general, nesting storks are more tolerant of low levels of human activity near a colony when nests are high in trees than when they are low, and when nests contain partially or completely feathered young than during the period between nest construction and the early nestling period (adults still brooding). When adult storks are forced to leave their nests, eggs or downy young may die quickly (<20 minutes) when exposed to direct sun or rain.

Colonies located in flooded environments must remain flooded if they are to be successful. Often water is between 3 and 5 feet deep in successful colonies during the nesting season. Storks rarely form colonies, even in traditional nesting sites, when they are dry, and may abandon nests if sites become dry during the nesting period. Flooding in colonies may be most important as a defense against mammalian predators. Studies of stork colonies in Georgia and

Florida have shown high rates of raccoon predation when sites dried during the nesting period. A reasonably high water level in an active colony is also a deterrent against both human and domestic animal intrusions.

Although nesting wood storks usually do most feeding away from the colony site (>5 miles), considerable stork activity does occur close to the colony during two periods in the nesting cycle. Adult storks collect almost all nesting material in and near the colony, usually within 2500 feet. Newly fledged storks, near the end of the nesting cycle, spend from 1-4 weeks during the fledging process flying locally in the colony area, and perched in nearby trees or marshy spots on the ground. These birds return daily to their nests to be fed. It is essential that these fledging birds have little or no disturbance as far our as one-half mile within at least one or two quadrants from the colony. Both the adults, while collecting nesting material, and the inexperienced fledglings, do much low, flapping flight within this radius of the colony. At these times, storks potentially are much more likely to strike nearby towers or utility lines.

Colony sites are not necessarily used annually. Regional populations of storks shift nesting locations between years, in response to year-to-year differences in food resources. Thus, regional populations require a range of options for nesting sites, in order to successfully respond to food availability. Protection of colony sites should continue, therefore, for sites that are not used in a given year.

III. Roosting habitat.

Although wood storks tend to roost at sites that are similar to those used for nesting, they also use a wider range of site types for roosting than for nesting. Non-breeding storks, for example, may frequently change roosting sites in response to changing feeding locations, and in the process, are inclined to accept a broad range of relatively temporary roosting sites. Included in the list of frequently used roosting locations are cypress "heads" or swamps (not necessarily flooded if trees are tall), mangrove islands, expansive willow thickets or small, isolated willow "islands" in broad marshes, and on the ground either on levees or in open marshes.

Daily activity patterns at a roost vary depending on the status of the storks using the site. Non-breeding adults or immature birds may remain in roosts during major portions of some days. When storks are feeding close to a roost, they may remain on the feeding grounds until almost dark before making the short flight. Nesting storks traveling long distances (>40 miles) to feeding sites may roost at or near the latter, and return to the colony the next morning. Storks leaving roosts, especially when going long distances, tend to wait for mid-morning thermals to develop before departing.

IV. Management zones and guidelines for feeding sites.

To the maximum extent possible, feeding sites should be protected by adherence to the following protection zones and guidelines:

A. There should be no human intrusion into feeding sites when storks are present. Depending upon the amount of screening vegetation, human activity should be no closer than between 300 feet (where solid vegetation screens exist) and 750 feet (no vegetation screen).

B. Feeding sites should not be subjected to water management practices that alter traditional water levels or the seasonally normal drying patterns and rates. Sharp rises in water levels are especially disruptive to feeding storks.

C. The introduction of contaminants, fertilizers, or herbicides into wetlands that contain stork feeding sites should be avoided, especially those compounds that could adversely alter the diversity and numbers of native fishes, or that could substantially change the characteristics of aquatic vegetation. Increase in the density and height of emergent vegetation can degrade or destroy sites as feeding habitat.

D. Construction of tall towers (especially with guy wires) within three miles, or high power lines (especially across long stretches of open country) within one mile of major feeding sites should be avoided.

V. **Management zones and guidelines for nesting colonies.**

A. Primary zone: This is the most critical area, and must be managed according to recommended guidelines to insure that a colony site survives.

1. Size: The primary zone must extend between 1000 and 1500 feet in all directions from the actual colony boundaries when there are no visual or broad aquatic barriers, and never less than 500 feet even when there are strong visual or aquatic barriers. The exact width of the primary zone in each direction from the colony can vary within this range, depending on the amount of visual screen (tall trees) surrounding the colony, the amount of relatively deep, open water between the colony and the nearest human activity, and the nature of the nearest human activity. In general, storks forming new colonies are more tolerant of existing human activity, than they will be of new human activity that begins after the colony has formed.

2. Recommended Restrictions:

a. Any of the following activities within the primary zone, at any time of the year, are likely to be detrimental to the colony:

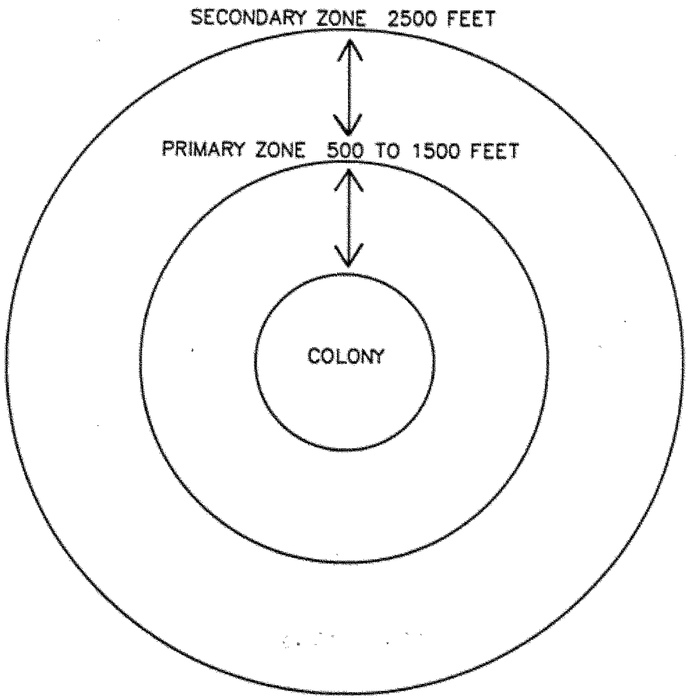
(1) Any lumbering or other removal of vegetation, and

(2) Any activity that reduces the area, depth, or length of flooding in wetlands under and surrounding the colony, except where periodic (less than annual) water control may be required to maintain the health of the aquatic, woody vegetation, and

(3) The construction of any building, roadway, tower, power line, canal, etc.

b. The following activities within the primary zone are likely to be detrimental to a colony if they occur when the colony is active:

(1) Any unauthorized human entry closer than 300 feet of the colony, and


SECONDARY ZONE 2500 FEET
PRIMARY ZONE 500 TO 1500 FEET
COLONY

(2) Any increase or irregular pattern in human activity anywhere in the primary zone, and

(3) Any increase or irregular pattern in activity by animals, including livestock or pets, in the colony, and

(4) Any aircraft operation closer than 500 feet of the colony.

B. Secondary Zone: Restrictions in this zone are needed to minimize disturbances that might impact the primary zone, and to protect essential areas outside of the primary zone. The secondary zone may be used by storks for collecting nesting material, for roosting, loafing, and feeding (especially important to newly fledged young), and may be important as a screen between the colony and areas of relatively intense human activities.

1. Size: The secondary zone should range outward from the primary zone 1000-2000 feet, or to a radius of 2500 feet of the outer edge of the colony.

2. Recommended Restrictions:

a. Activities in the secondary zone which may be detrimental to nesting wood storks include:

(1) Any increase in human activities above the level that existed in the year when the colony first formed, especially when visual screens are lacking, and

(2) Any alteration in the area's hydrology that might cause changes in the primary zone, and

(3) Any substantial (>20 percent) decrease in the area of wetlands and woods of potential value to storks for roosting and feeding.

b. In addition, the probability that low flying storks, or inexperienced, newly-fledged young will strike tall obstructions, requires that high-tension power lines be no closer than one mile (especially across open country or in wetlands) and tall trans-mission towers no closer than 3 miles from active colonies. Other activities, including busy highways and commercial and residential buildings may be present in limited portions of the secondary zone at the time that a new colony first forms. Although storks may tolerate existing levels of human activities, it is important that these human activities not expand substantially.

VI. Roosting site guidelines.

The general characteristics and temporary use-patterns of many stork roosting sites limit the number of specific management recommendations that are possible:

A. Avoid human activities within 500-1000 feet of roost sites during seasons of the year and times of the day when storks may be present. Nocturnal activities in active roosts may be especially disruptive.

B. Protect the vegetative and hydrological characteristics of the more important roosting sites--those used annually and/or used by flocks of 25 or more storks. Potentially, roosting sites may, some day, become nesting sites.

VII. Legal Considerations.

A. Federal Statutes

The U.S. breeding population of the wood stork is protected by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act). The population was listed as endangered on February 28, 1984 (49 Federal *Register* 7332); wood storks breeding in Alabama, Florida, Georgia, and South Carolina are protected by the Act.

Section 9 of the Endangered Species Act of 1973, as amended, states that it is unlawful for any person subject to the jurisdiction of the United States to take (defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.") any listed species anywhere within the United States.

The wood stork is also federally protected by its listing (50 CFR 10.13) under the Migratory Bird Treaty Act (167 U.S.C. 703-711), which prohibits the taking, killing or possession of migratory birds except as permitted.

B. State Statutes

1. State of Alabama

Section 9-11-232 of Alabama's Fish, Game, and Wildlife regulations curtails the possession, sale, and purchase of wild birds. "Any person, firm, association, or corporation who takes, catches, kills or has in possession at any time, living or dead, any protected wild bird not a game bird or who sells or offers for sale, buys, purchases or offers to buy or purchase any such bird or exchange same for anything of value or who shall sell or expose for sale or buy any part of the plumage, skin, or body of any bird protected by the laws of this state or who shall take or willfully destroy the nests of any wild bird or who shall have such nests or eggs of such birds in his possession, except as otherwise provided by law, shall be guilty of a misdemeanor...

Section 1 of the Alabama Nongame Species Regulation (Regulation 87-GF-7) includes the wood stork in the list of nongame species covered by paragraph (4). " It shall be unlawful to take, capture, kill, possess, sell, trade for anything of monetary value, or offer to sell or trade for anything of monetary value, the following nongame wildlife species (or any parts or reproductive products of such species) without a scientific collection permit and written permission from the Commissioner, Department of Conservation and Natural Resources,..."

2. State of Florida

Rule 39-4.001 of the Florida Wildlife Code prohibits "taking, attempting to take, pursuing, hunting, molesting, capturing, or killing (collectively defined as "taking"), transporting, storing, serving, buying, selling, possessing, or wantonly or willingly wasting any wildlife or freshwater fish or their nests, eggs, young, homes, or dens except as specifically provided for in other rules of Chapter 39, Florida Administrative Code.

Rule 39-27.011 of the Florida Wildlife Code prohibits "killing, attempting to kill, or wounding any endangered species." The "Official Lists of Endangered and Potentially Endangered Fauna and Flora in Florida" dated 1 July 1988, includes the wood stork, listed as "endangered" by the Florida Game and Fresh Water Fish Commission.

3. State of Georgia

Section 27-1-28 of the Conservation and Natural Resources Code states that "Except as otherwise provided by law, rule, or regulation, it shall be unlawful to hunt, trap, fish, take, possess, or transport any nongame species of wildlife..."

Section 27-1-30 states that, "Except as otherwise provided by law or regulation, it shall be unlawful to disturb, mutilate, or destroy the dens, holes, or homes of any wildlife; "

Section 27-3-22 states, in part, "It shall be unlawful for any person to hunt, trap, take, possess, sell, purchase, ship, or transport any hawk, eagle, owl, or any other bird or any part, nest, or egg thereof...".

The wood stork is listed as endangered pursuant to the Endangered Wildlife Act of 1973 (Section 27-3-130 of the Code). Section 391-4-13-.06 of the Rules and Regulations of the Georgia Department of Natural Resources prohibits harassment, capture, sale, killing, or other actions which directly cause the death of animal species protected under the Endangered Wildlife Act. The destruction of habitat of protected species on public lands is also prohibited.

4. State of South Carolina

Section 50-15-40 of the South Carolina Nongame and Endangered Species Conservation Act states, "Except as otherwise provided in this chapter, it shall be unlawful for any person to take, possess, transport, export, process, sell, or offer of sale or ship, and for any common or contract carrier knowingly to transport or receive for shipment any species or subspecies of wildlife appearing on any of the following lists: (1) the list of wildlife indigenous to the State, determined to be endangered within the State...(2) the United States' List of Endangered Native Fish and Wildlife... (3) the United States' List of Endangered Foreign Fish and Wildlife ..."

APPENDIX E
Indigo Snake Protection Measures

STANDARD PROTECTION MEASURES FOR THE EASTERN INDIGO SNAKE

1. An eastern indigo snake protection/education plan shall be developed by the applicant or requestor for all construction personnel to follow. The plan shall be provided to the Service for review and approval at least 30 days prior to any clearing activities. The educational materials for the plan may consist of a combination of posters, videos, pamphlets, and lectures (*e.g.*, an observer trained to identify eastern indigo snakes could use the protection/education plan to instruct construction personnel before any clearing activities occur). Informational signs should be posted throughout the construction site and along any proposed access road to contain the following information:

    a. a description of the eastern indigo snake, its habits, and protection under Federal Law;
    b. instructions not to injure, harm, harass or kill this species;
    c. directions to cease clearing activities and allow the eastern indigo snake sufficient time to move away from the site on its own before resuming clearing; and,
    d. telephone numbers of pertinent agencies to be contacted if a dead eastern indigo snake is encountered. The dead specimen should be thoroughly soaked in water and then frozen.

2. If not currently authorized through an Incidental Take Statement in association with a Biological Opinion, only individuals who have been either authorized by a section 10(a)(1)(A) permit issued by the Service, or by the State of Florida through the Florida Fish Wildlife Conservation Commission (FWC) for such activities, are permitted to come in contact with an eastern indigo snake.

3. An eastern indigo snake monitoring report must be submitted to the appropriate Florida Field Office within 60 days of the conclusion of clearing phases. The report should be submitted whether or not eastern indigo snakes are observed. The report should contain the following information:

    a. any sightings of eastern indigo snakes and
    b. other obligations required by the Florida Fish and Wildlife Conservation Commission, as stipulated in the permit.

Revised February 12, 2004

APPENDIX F
Service Response Letter to Frog Pond Ecological Risk Assessment

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

May 27, 2009

Robert Taylor
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Florida 33406

Dear Mr. Taylor:

The Fish and Wildlife Service (Service) has reviewed the Ecological Risk Assessment (ERA) and the Additional Soil Investigation for the Frog Pond, prepared by Newfields and URS Corporation (URS), respectively. These documents report contaminant concentrations and the predicted risk associated with using the Frog Pond for the construction of a 570-acre water detention area in the C-111 Spreader Canal Project. The proposed detention area is intended to act as a 'leaky' reservoir, allowing water to infiltrate to groundwater. The infiltration is expected to create a hydrologic buffer that will force groundwater flows into Taylor Slough to the west and keep regional groundwater from flowing into the C-111 canal to the east.

A 2006 Phase II Environmental Site Assessment on 1,380 acres at the Frog Pond identified soil concentrations of copper, zinc, and 4,4′-DDE that predicted risk to Service trust resources (Service comment letter dated May 1, 2007). Since this Phase I/II assessment, the footprint of the water detention area shifted to the west, resulting in an area of approximately 350 acres that had not undergone sampling. In the Additional Soil Investigation, composite soil samples were collected from seven, 50-acre grids throughout this 350-acre area within the new Frog Pond Detention Area footprint. Analytical results were compared to Florida Department of Environmental Protection Sediment Quality Assessment Guidelines (SQAG) and the Florida Administrative Code Soil Cleanup Target Levels.

A low concentration, below the SQAG, of the organochlorine pesticide 4,4′-DDE was detected in one of the seven composite samples. Endosulfan, which has no SQAG, was detected in four of the composite samples at concentrations below the calculated site-specific SQAG (9.14 µg/kg). All other pesticides were below their respective laboratory detection limits. Four of the composite samples detected copper at a concentration above the interim screening level for the protection of the endangered Everglade snail kite (*Rostrhamus sociabilis plumbeus*) (85 mg/kg), ranging from 136 to 224 mg/kg. Zinc concentrations slightly exceeded the SQAG threshold effect concentration (TEC) (120 mg/kg) in two of the composite samples.

In 2007, a pilot scraping study was conducted in a 5-acre portion of the 350-acre Frog Pond area to determine if contaminated soils (mean of 202 mg/kg copper and 172 mg/kg zinc) could be effectively removed from the solution riddled limestone. Results from this study found that copper and zinc concentrations in the scraped area remained above the interim screening level (85 mg/kg) and the TEC (120 mg/kg), respectively.

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The Frog Pond detention area will likely be subject to frequent wetting/drying cycles. Standing water is likely to persist in solution areas, where soils were shown to remain after scraping. The length of time water would persist is hard to predict, but if these areas persist long enough, an aquatic community could become established and attract aquatic feeding avian fauna. To further evaluate the risk associated with flooding Frog Pond soils, an Ecological Risk Assessment was performed with soils from the Frog Pond. Bulk soil samples were collected from three locations at the Frog Pond: two samples (CS-8 [copper = 140 mg/kg] and CS-10 [copper = 97 mg/kg]) were collected from the scraped pilot study area and one sample (grid 6) was collected from an area identified as having the highest observed copper concentration (365 mg/kg). Bioaccumulation tests (28 day) were conducted using the worm, *Lumbriculus variegatus*, and the Florida apple snail, *Pomacea paludosa*. Toxicity tests (10-day acute) were performed using *Chironomus dilutus* and *Hyalella azteca*. A survey was also conducted in the 5-acre pilot study area to determine the depth and aerial extent of soil remaining after scraping. Soil samples were collected from the survey area at both shallow (soil < 1 inch deep) and deep (soil > 1 inch deep) locations.

In an attempt to mimic the repeated wetting cycles detention areas undergo, soils were acclimated six times through static-renewal with synthetic freshwater (renewals at days 7, 12, 17, 27, 37, and 48). Results from the acclimation phase of the study found a general decrease in the concentration of copper in the soil/sediments, with the greatest rate of decline between day 1 and 7. At the end of the acclimation period, copper in sediments exceeded the TEC (32 mg/kg) in CS-8 (79 mg/kg) and CS-10 (63 mg/kg) and the SQAG probable effect concentration (PEC) (150 mg/kg) in grid 6 (225 mg/kg). Soils with higher copper concentrations resulted in higher dissolved copper in the water. Copper (dissolved) in surface water in the acclimation phase increased from day 1 to day 7 and then sharply decreased to day 17 and remained relatively constant throughout the end of the acclimation phase at day 48. There was relatively little difference in the concentrations of dissolved copper at day 1 and day 48, especially for CS-10 and grid 6. Concentrations of copper in water were at or above the Florida Administrative Code Surface Water Quality Criteria throughout 6 of the 7 sampling events for grid 6 and in one sampling event with soils from CS-8. Endosulfan sulfate (0.02 to 0.04 µg/L) also exceeded the surface water quality critera (≤ 0.056 µg/L) at three of the sampling events.

The 28-day bioaccumulation test run with *L. variegatus* in acclimated grid 6 soils (365 mg/kg copper) detected an average of 282 mg/kg dw copper in worms, compared to 23 mg/kg dw in worms from control soils. Apple snails bioaccumulated copper at an average of 121 mg/kg dw with CS-8 soils, 70.2 mg/kg dw with CS-10 soils, and 325 mg/kg dw with grid 6 soils, compared to only 19.8 mg/kg dw from control soil.

Survival and growth for *H. azteca* and *C. dilutus* in CS-8 and CS-10 soils (acclimated and unacclimated) were not significantly different from the control. *H. azteca* in grid 6 soils (acclimated and unacclimated) had significantly lower survival and biomass as compared to the control. Mean growth and survival for *C. dilutus* in grid 6 (unacclimated) soils was significantly lower than the control.

Five samples collected from the pilot study area showed considerably higher levels of copper (mean of 140 mg/kg) in the shallow soil samples (0 to 1 inch deep) than those collected from deep soils (0 to a minimum of 6 inches deep) within solution cavities (mean of 14 mg/kg). The survey to determine the percent of soil remaining after scraping found approximately 39 percent of the area with no soil, 50 percent with thin soils (<1 inch), and 11 percent with thick soils (>1 inch). Vertical delineation sampling at eight locations found that copper concentrations greatly decline with depth. None of the samples collected at depths greater than 1 inch exceeded 85 mg/kg.

To reduce the risk from elevated copper concentrations, URS recommended that the proposed 570-acre Frog Pond detention area undergo soil scraping, with the exception of grids G-31, G-32, and G-33, which did not exceed the interim screening value for copper. Excavated soils are planned for use in construction of detention area berms or will be placed east of the project towards the C-111 Canal. In addition, confirmatory sampling is recommended to document the effectiveness of soil scraping.

Summary and Comments

The detected levels of copper in the proposed Frog Pond detention area present a concern for Service trust resources, specifically the endangered Everglade snail kite. Average (148 mg/kg) and 95 percent upper confidence level (UCL) (177 mg/kg) copper concentrations in the proposed Frog Pond detention area exceed the interim screening value (85 mg/kg) for the protection of the snail kite. The copper bioaccumulation study with apple snails found considerably lower biota-sediment accumulation factors (BSAF) (0.9) than a study by Frakes et al. (2008) (7 to 37). This is likely due to the lack of exposure through diet, which has been shown by Hoang et al. (2008) to be a more important route of uptake as compared to sediment exposure. Because no dietary route of uptake was considered, the bioaccumulation study did not represent the potential bioaccumulation upon inundation of Frog Pond soils. Even without accounting for dietary exposure to copper, the maximum concentrations observed using grid 6 soils (426 mg/kg dw) approached the critical snail body burden (estimated at 450 mg/kg dw). Using the snail tissue concentrations from the bioaccumulation study in place of the default BSAF in the food-web model, highly underestimates the exposure to snail kites.

The Service does not concur with the ERA conclusion that bioavailable copper concentrations are expected to be reduced with repeated flooding. The soil acclimation phase of the ERA detected water concentrations that exceeded the surface water quality criteria. There was little difference between the copper concentrations in overlying water from the initial flooding and the seventh flooding during the acclimation phase. A study by Hoang et al. (2008) showed that while there may be a slight decrease in dissolved copper concentration in water with repeated flooding events, the concentration of free copper (Cu^{+2}), which is highly bioavailable, increased with the number of flooding events due to a decrease in dissolved organic carbon (DOC).

Detected concentrations of other metals and pesticides were noticeably lower than previously sampled areas outside of the project footprint. The site-wide 95 percent UCL for endosulfan (20.37 μg/kg) exceeded its calculated site-specific SQAG (9.14 μg/kg). The maximum observed concentration of endosulfan (66.3 μg/kg) predicted no risk to avian fauna using the food-web model (hazard quotients [HQ] < 0); however, impacts to the aquatic community and fish are possible. Mean concentrations for 4,4'-DDE (1.2 μg/kg), chlordane (1.1 μg/kg), and zinc (102 mg/kg) were below SQAG. The mean (45.3 mg/kg) and 95 percent UCL (49.8 mg/kg) for chromium were just above the TEC (43 mg/kg), but have a low potential of posing risk to the benthic community.

Confirmatory sampling conducted as part of the pilot scraping study found an average residual copper concentration of 145 mg/kg with a 95 percent UCL of 173 mg/kg. Further sampling conducted in the ERA to determine the vertical distribution of copper at the scraped grid found an average copper concentration of 93 mg/kg with a 95 percent UCL of 106 mg/kg. Newfields used this 95 percent UCL for copper (106 mg/kg) to calculate the area-weighted concentration expected after soil scraping. An estimated 65 mg/kg of copper was calculated for the area-weighted concentration, which is below the 85 mg/kg interim screening value. There is no mention of the pilot study confirmatory sampling results in the ERA. If the 95 percent UCL from the confirmatory sampling is used in place of the 95 percent UCL from the vertical delineation, then the area-weighted copper concentration estimated for scraped soils (106 mg/kg) exceeds the interim screening value for copper. Unless there is a valid reason to discount confirmatory sampling results, the Service recommends that all available data should be used to estimate the area-weighted average copper concentration. Using the Service calculated 95 percent UCL from both the ERA and the draft pilot study report resulted in an estimated area-weighted average of 80 mg/kg copper. Regardless of the 95 percent UCL that is used in the area-weighted calculation, we feel that five acres is an insufficient area to calculate a 95 percent UCL for a 570-acre site.

The Service concurs with the recommendation for soil scraping, provided that post-scraping confirmatory sampling be conducted on a representative percentage of the project site. Confirmatory sampling should include a measure of the relative percent of soil remaining and the concentration of copper within these soils. These data should be used to calculate an estimated area-weighted average for the entire Frog Pond detention area. Once these confirmatory samples are collected, determination about the need for monitoring or further remediation can be made. We recommend that if Frog Pond soils are to be reused in the construction of berms, they pass all leachability testing criteria.

Thank you for the opportunity to provide comments regarding the Frog Pond Property. If you have any questions, please contact Emily Bauer at 772-562-3909, extension 335.

Sincerely yours,

Robert Fraker

for Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc: electronic only
DEP, West Palm Beach, Florida (Joe Lurix)
Corps, West Palm Beach, Florida (Tori White)
Newfields, Boulder, Colorado (Joe Allen)
URS, Boca Raton, Florida (Edward Leding)

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A.2 RECOMMENDATIONS AND RESPONSES UNDER THE FISH AND WILDLIFE COORDINATION ACT PLANNING AID LETTERS

RECOMMENDATIONS/CONSERVATION MEASURES

A. Altered Hydrology and Operations

1. The Service recommends that the Corps and District review proposed project operations to assess their effects to the productivity of wading bird habitat that model output indicates will have a reduced hydroperiod in the ENP panhandle area, south of the C-111 canal between S-18C and S-197. Sufficient water depth and duration is needed for prey production prior to initiation of nesting. Once wading bird nests are initiated, water depth and recession rate needs to be optimized to make prey available for foraging.

Response: The proposed project is a re-distribution project which was largely championed by DOI. Because of uncertainties inherent in any modeling effort, the actual in-situ effects of these changes cannot be predicted with a high degree of certainty. It is for this reason, and in order to minimize possible effects on the marsh environment and associated fauna, that monitoring based adaptive management protocols have been included within the Draft Project Operating Manual (DPOM). Please see Section D.7.8 of the DPOM, Panhandle Wetland and Salt Water Intrusion Protection Measures.

2. A review of proposed project operations in the C-111 canal that affect discharge through the S-197 should also be conducted. While elimination of excessive flows through this structure and moderation of salinity fluctuations was a project goal, there remains a need to provide an adequate base flow level for maintenance of a natural salinity regime in Manatee Bay and Barnes Sound and should be considered during implementation of Phase 1 and planning for Phase 2.

Response: As discussed previously, the proposed project is a re-distribution project, and returning to a more natural distribution may cause some areas to receive less water than received under current conditions. Under existing conditions, S-197 generally discharges to Manatee Bay only in response to major storm events, and can cause rapid changes in salinity. The proposed project is anticipated to reduce both the frequency and severity of these rapid salinity changes. If it becomes apparent, through implementation of the Project Level Monitoring Plan, that the reductions in anthropogenic freshwater inputs will result in adverse impacts to Manatee Bay, the Project can be adaptively managed, and Preliminary Project Operating Manual (PPOM), and Final Project Operating Manual (FPOM) revised to alleviate these effects, to the extent that doing so would remain consistent with overall project purposes.

3. The Service recommends monitoring the effects of the installation of the ten C-110 canal plugs. This monitoring should include intensified monitoring of stage and flow gradient before and following construction to determine if the

hydrological characteristics have changed due to the plugs. If data indicate that the drainage effect of the canal on surrounding marshlands has not been sufficiently reduced, then an evaluation of the feasibility of a complete canal backfill should be conducted.

Response: The cumulative effects of all project features will be monitored as part of the project level monitoring plan. It is unlikely that monitoring would be able to isolate the effects of this secondary project component. The effectiveness of the plugs will be evaluated through comparison of water budgets and nearby water level recorders.

4. A wide variety of barriers to both surface and groundwater flow such as roads, ditches, canals, levees, building pads, and rock pits, will still exist in the C-111 SC Project study area after Phase 1 project construction. Hydrologic monitoring as part of post construction monitoring should be conducted with consideration of how these features may be affecting project success and how modification or removal of these structures may facilitate successful implementation of Phase 2.

Response: The Western PIR features are intended to achieve early restoration. A spreader canal design test was "spun off" from this project in order to resolve some decision critical uncertainties regarding the second phase. The impacts of roads, ditches, canals etc. on surface and groundwater flows are well documented and are not considered decision critical uncertainties. While we encourage the PDT to support removal of these features within the subsequent PIR, the need to monitor these features is not obvious, particularly as part of the Western PIR. The Western PIR monitoring plan, however, does support an evaluation of the regional water level conditions as part of the project operations. This is consistent with the anticipated benefits that are expected to be achieved by focus on regional improvement in water levels for Taylor Slough, the Model Lands and other areas as seepage losses to regional canals are reduced by the induced hydraulic barriers at the Frog Pond, Aerojet Canal and canal plugs at C-110 and L-31E.

5. The Service recommends that the Corps evaluate the impingement and entrainment of fishes and other aquatic organisms at all project inflow pumps as a pilot project to estimate the significance of cumulative impacts on native fishes, and recreational and commercial fisheries, for all the pumps in the C-111SC selected plan. The pilot project should evaluate intake designs, screens, and pump type (*e.g.*, screw-type pumps should injure or kill fewer fish than impeller-type pumps). Furthermore, the Service recommends that any new pumps that are installed prior to the end of the pilot project have the capability to be retrofitted with devices (such as screens) that will reduce or eliminate impingement and entrainment of fish and other aquatic life.

Response: Paragraph 6-4 of our Engineer Manual EM 1110-2-3102 indicates that conventional bar screens (trash racks) are the preferred method of screening. For most pumps, the Corps has used 3 inch bar spacing. The potential use of fish screens can be further evaluated to see where they have been used successfully for similar applications. The Corps will determine whether they can be used in a manner that will not adversely affect the flow and head conditions of the pumps, can be readily cleaned, and are at a reasonable cost. Note that the suction bells at our pump stations generally pass water through them at no more than 5 or 6 feet per second. We have seen no indication that this relatively slow velocity has been causing significant numbers of fish to be drawn into pumps. Screw-type pumps will also be evaluated to see if they would be applicable to this project.

B. Water Quality

1. The water quality of the C-111E canal has the potential for disrupting the ecology of marsh areas that may be receiving inflows. Contaminants detected by past monitoring studies of the C-111E canal include metals (*e.g.*, lead, chromium, cadmium, zinc, and copper) and pesticides (*e.g.*, atrazine, endosulfan, and DDT) (Carriger et al., 2006; Carriger and Rand, 2008a, 2008b). Pumping operations that are part of the C-111 SC Design Test Project (proposed to test spreader canal feasibility on a small scale) and future full scale spreader canal implementation in Phase 2 could result in this impaired water quality potentially entering surrounding marshes. The Service recommends that planning for the C-111 SC Water Quality Pilot Project (proposed to test feasibility of water quality treatment technologies) be resumed and the proposed project implemented after a full analysis of feasibility.

Response: The spreader canal design test was coordinated with the FWS under a separate NEPA action. The design test includes water quality monitoring necessary to meet the requirements of the CERP RA permit, which was coordinated with the FWS and FDEP. Previous PDT meetings failed to gain the support of the entire PDT for the construction, location, and purpose of an infiltration basin. PDT members who had concerns with the test as described by the Corps and the SFWMD were asked to develop proposals, but none were received. It is important to note that the C-111 SC Design Test is being developed as a separate project, and the Infiltration Basin Pilot Project would have to be developed as a separate project.

2. The Service recommends that the Corps, District and the C-111 SC PDT work collaboratively to develop a water quality monitoring plan and sampling points for both surface and groundwater that may include new well points or monitoring locations at areas of concern (such as the FPDA feature, Aerojet Canal feature, C-111 Design Test project, and C-111 SC Phase 2 proposed full scale spreader canal potential corridor) to adequately assess environmental risk.

If contaminants are found during project monitoring at levels that exceed those established by the U.S. Environmental Protection Agency (EPA) to protect aquatic life (EPA, 2002), the Corps should modify project operations and monitoring accordingly and coordinate with the Service and other stakeholders.

Response: The Federal and Local Project Sponsors intend to continue to work collaboratively with the USFWS to determine if and where monitoring would be required in order to mitigate concerns resulting from areas where contaminated soils have been identified. We concur that operations, and possibly monitoring, should be modified if, during monitoring, contaminants are found at levels that exceed those established by the EPA to protect aquatic life (EPA 2002). It is important to note that the C-111 Design Test, and the C-111 SC full scale spreader canal are being developed as separate projects.

C. Contaminants

1. Detected levels of copper in the original Ecological Risk Assessment and the Additional Soil Investigation in the proposed FPDA prepared by Newfields and URS Corporation for the District presented a concern for Service trust resources, including the endangered Everglade snail kite. Whereas detected concentrations of other metals and pesticides compared to the original Ecological Risk Assessment were noticeably lower in the Additional Soil Investigation conducted within the project footprint due to a change in the footprint. The maximum observed concentration of endosulfan (66.3 µg/kg) predicted no risk to avian fauna using a food-web model (hazard quotients <0); however, impacts to the aquatic community and fish are still possible. The Service concurred with the District recommendation for soil scraping and use of this soil for construction of berms capped with clean soil. This concurrence is provided post-scraping confirmatory sampling is conducted on a representative percentage of the project site and levels of metals and pesticides are sufficiently low, based on an Ecological Risk Assessment, to pose a minimal hazard to wildlife. The confirmatory sampling should include a measure of the relative percent of soil remaining within the scraped footprint and the concentration of copper, other metals, and pesticides within these soils. Additional detail on the Service position is provided in Appendix F.

Response: Concur

2. To date, Modbranch modeling indicates that in an average year up to 90 ac of the FPDA could be inundated for 80 days or longer at an average depth of 1 ft. These conditions could sustain a short hydroperiod wetland vegetation community and its associated fauna, which have the potential for contaminant uptake and bioaccumulation. In addition, drying conditions that concentrate any prey entrained in pumped flows from the C-111 canal may attract foraging

migratory bird species. To prevent potential contaminant exposure to fish and wildlife resources, corrective actions may be necessary. Once soil sampling is complete for the entire FPDA, the Service can issue recommendations on the necessity of specific corrective actions and monitoring.

Response: As stated previously, the Federal and Local Project Sponsors intend to continue to work with the FWS to determine if and where monitoring would be required in order to mitigate concerns resulting from areas where contaminated soils have been identified.

D. Migratory Birds

1. The C-111 SC project study area encompasses a wide variety of habitats including wooded, marsh, estuarine, and shoreline habitats that are extremely important as habitat for migratory birds. Maintaining these sites as high-quality habitat for migratory birds is important and final project design; construction and operation need to be accomplished with full consideration to preservation and maintenance of viable migratory bird habitat.

Response: Noted

2. Lucky Hammock, located beside Aerojet Road, is an important "jumping off" site for migratory birds in the Atlantic Flyway, benefiting both migratory birds and bird watchers. This area is part of the Great Florida Birding Trail and implementation of the proposed Aerojet Canal component of the C-111 SC Project should preserve both the integrity of this habitat and access for birders. Final project design, construction, and operation should be accomplished so that this area is not negatively impacted by changes in hydrology, displaced by project components, or disturbed by construction activities.

Response: Noted

E. Hydrologic Modeling Issues

1. Use of the Modbranch model during project planning to simulate hydrology in the project study area for three representative years weakened our ability to analyze to the detail that could have provided scrutiny of each individual year over a period of record and the statistical power inherent in examination of a population of years. As project construction and operation proceeds, the effects of climatic and associated hydrologic variation within the annual cycle need to be further scrutinized and adjusted for in operations to maximize project benefits and minimize adverse effects to project study area habitat and wildlife.

Response: Noted. Real data as they accumulate will provide verification of model predictions. Due to other modeling limitations it is doubtful that more extensive modeling is justified.

2. Discrepancies between the base ground surface elevation coded into the Modbranch model and known ground-truthed locations within the project study area need to be further investigated and corrections made as part of project implementation. In some cases these comparative elevations may have differed by up to 1 foot. These differences could appreciably change modeled project effects.

Response: Concur. Uncertainties in ground surface elevations represent an additional risk to the predictive capabilities of the model. It is because of these, and other, uncertainties that we have incorporated adaptive management strategies into the Draft Project Operating Manual (DPOM). The Federal and Local Sponsor believe resolution of these topographic inconsistencies should be one of the first activities undertaken as part of the data acquisition phase of the Eastern C-111 Spreader Canal project.

F. Monitoring and Adaptive Management Plans

1. Given the uncertainties related to modeling and effects of the proposed project implementation, the development of sound monitoring and adaptive management plans is vital to the success of this project. The Service recommends close adherence to the water quality and ecological monitoring plans established for the C-111 SC Project, including the ecological monitoring specified in the RECOVER Monitoring and Assessment Plan and the project-level monitoring plans appearing in the PIR. This monitoring should be periodically evaluated for relevance and usefulness. Also, the Service recommends that an adaptive management plan be developed for the project and implemented to maximize the restoration success of the project and to provide information for the planning and construction of Phase 2 of the project. This adaptive management plan should also be periodically reviewed and revised as appropriate. This process should facilitate the restoration and enhancement of the C-111 SC Project's wetland and estuarine habitats.

Response: We agree that the intent in developing the water quality and ecological monitoring plans (Annex E of the draft PIR/EIS) is to evaluate the overall restoration progress of the project. We also agree that the monitoring may facilitate adaptive operational changes, and is the basis of the operating strategy for the project. In addition, flexibility in the project operations has been incorporated to determine how additional project benefits can be achieved by water management changes at the S-18C structure. Results of this first phase of restoration will provide significant guidance in the future planning and *recommendations for further improvements associated with the Eastern C-111 SC project implementation. We do not agree that a formal project level adaptive management plan is necessary until this first phase of implementation has been completed and results have been evaluated. An adaptive management plan developed in concert with the implementation of the Eastern C-111 SC would provide a more meaningful basis to improve regional wetlands and Florida Bay estuaries.*

G. Integrating the Project with Comprehensive Restoration Efforts

1. As other features of the CERP are designed and operated, water management protocols for C-111 SC Project components need to be reconsidered in the context of the modified C&SF project. This may include provisions for a future increase in water availability, storage capacity and treatment, and modification of operations for elements of the selected plan to benefit Florida Bay, its coastal wetlands, and the Southern Glades, that are consistent with the C-111 SC Phase 1 and Phase 2 goals and objectives.

Response: The Programmatic Regulations provide for the assessment of synergistic effects between CERP projects and identification of other water needs through RECOVER. As additional CERP features come on line, opportunities for additional project benefits may be realized. As the entity responsible for the regional coordination and evaluation of system wide benefits, the Project Sponsors will continue to look to RECOVER to identify and exploit those opportunities, either through operational changes, structural changes, or both.

H. Protection and Recovery Measures for Listed Species

1. Some of the proposed construction sites and effects will occur on public or private properties for which we have limited information regarding the presence of federally listed species. Therefore, as those sites are accessed or acquired (or easements are negotiated), the Corps should ensure that more detailed surveys are conducted by qualified biologists to determine the presence of listed species. If listed species are found, the Corps and Service will determine if re-initiation of consultation in accordance with section 7 of the Act is necessary.

Response: Most of the construction sites are located on public properties which have had numerous site visits by qualified biologists including USFWS biologists. As stated in the Environmental Commitments (Section 8.8), the USACE and the SFWMD will maintain an open and cooperative informal consultation process with the FWS and Florida Fish and Wildlife Conservation Commission (FWC) throughout the design, construction and operation of this restoration project.

2. The Service is concerned about the potential for the exposure of federally listed species, as well as other fish and wildlife, to contaminants when former agricultural lands are flooded. If the ecological risks from contaminants to listed species become evident, the Corps and Service will determine if re-initiation of consultation in accordance with section 7 of the Endangered Species Act is necessary.

Response: Concur. We understand that the Service is reserving the right to reinitiate consultation should ecological risks from contaminants to listed species become evident.

3. The Corps should notify the Service's South Florida Ecological Services Office no later than one month prior to start of the construction phase for any of the components so that we may, if available, observe construction activities and monitor effects, if any, of construction activities on threatened and endangered species.

Response: Concur.

4. Should blasting be necessary, the Corps should follow the Service's "Guidelines for the Protection of Marine Animals During the Use of Explosives In the Waters of the State of Florida" (Service 2006), and monitor local wildlife activity during this action. Care should be taken to avoid unnecessary disturbance of roosting, foraging, or wading birds or other local wildlife such as perching birds, raptors, waterfowl, mammals, reptiles, amphibians, and fish that utilize associated habitats. A qualified fish and wildlife biologist, approved by the Service and the FWC, should be present throughout blasting activities to monitor fish and wildlife response and offer advice to construction personnel.

Response: Concur. If blasting is required, the USACE will follow the USFWS guidelines, as recommended.

5. The Service recommends adding wildlife corridors beneath or through roadways, particularly Card Sound Road, to reduce crocodile mortality caused by motorized vehicles. Mortality from automobiles account for a large number of crocodile deaths in south Florida, and it is particularly a problem along Card Sound Road, which is in the project area. The Service recognizes that this recommendation falls outside the spatial scope for the Tentatively Selected Plan, but these corridors should be given a high priority for Phase 2 of the C-111 SC Project.

Response: Noted. Wildlife corridors will be strongly considered during the C-111 SC Eastern Project PIR.

6. For additional species listed as threatened, endangered, or of special concern by the State of Florida, the Corps should consult with the FWC regarding those species' habitat needs and additional recommendations to conserve those species.

Response: Coordination with resource agencies, including the FWC, has been on-going throughout the planning process of this project. Additionally, the FWC will be providing formal comments on the draft PIR/EIS during the public and agency review period.

Florida Panthers

7. The C-111 SC study area is within the designated Primary Zone of the Panther Focus Area for the Florida panther (FWS, 2006a) and the project construction area footprint will be contained within this zone. The habitat value for Florida panther within the project study area is considered to be moderate with occasional dispersal activity from the panther core population farther west in ENP and Big Cypress National Preserve. Recent mortalities from vehicle collisions have occurred. Any panthers utilizing the study area habitat could be impacted by noise from construction activities. Preliminary construction planning information provided by the District indicated that based on anticipated equipment and vehicle access needs there could be a considerable increase in vehicle and equipment traffic accessing the project sites on levees, the FPDA site, and throughout the study area where construction will occur. These increases cannot be quantified until final construction plans have been completed. Precautions should be taken to avoid potential collisions with panthers including speed restrictions and limiting construction activities to daylight hours when any panthers present would be less active.

Response: The Federal and non-Federal sponsor would like to discuss the specifics of this request with the FWS before concurring or not concurring with this recommendation.

West Indian Manatee

8. The L-31N and C-111 canals are accessible to West Indian manatees. These canals should be surveyed in the project study area by qualified observers to monitor manatee presence prior to construction as well as during project construction. Any new canals that are constructed as part of this project that are hydraulically connected to Florida Bay (or any other water bodies inhabited by, or capable of being inhabited by, manatees) must have barriers to prohibit manatee movement into newly constructed canal reaches from the bay (or other relevant water bodies inhabited by manatees). This includes the proposed C-111 SC Design Test canal associated with this project. Such barriers will ensure that C-111 SC Project facilities will pose no additional threat of structure-caused

mortality or injury, entrapment in culverts or canals, or any other form of take, as defined in the Act and Marine Mammal Protection Act. Manatee barriers should be provided for all new pump stations, culverts, and other structures as appropriate.

Response: Concur. The Corps has included standard manatee protection measures in the Biological Assessment (Annex A). Any additional protection measures will require further agency coordination.

Everglade Snail Kite

9. None of the project study area impacts critical habitat designated for the Everglades snail kite. The presence of foraging and nesting snail kites is possible in the project study area and project construction site as well as access and staging corridors. If possible, construction should be planned outside the potential nesting season (December 1 to July 31). Regardless, surveys should be conducted prior to and during construction according to Snail Kite Survey Protocol (Appendix B), in addition to accessing all additional data from resource managers and researchers on presently documented locations of foraging areas, snail kite nest sites, and kite protection buffers. Draft Snail Kite Management Guidelines (Appendix C) for protection buffers and management areas should be followed.

Response: The Federal and non-Federal sponsor would like to discuss the specifics of this request with the FWS before concurring or not concurring with this recommendation the proposed construction area is well south of current snail kite nesting sites, and we do not concur that restricting construction as recommended would be beneficial..

10. Construction activities and equipment operation associated with the project could create noise levels that could be disturbing to kites and other wildlife depending on the decibel level and distance needed to attenuate those noise levels. Data is available on typical construction noise levels and its effects on wildlife (Cowan, 1993; U.S. Department of Energy, 2001; Imperial Oil Resources Ventures Limited, 2005; Knauer, 2006). These and other studies have documented various disturbance effects such as nest relocation, interrupted brooding, and flushing on avian wildlife at noise ranges above 40 decibels (dBA). Noise levels should be monitored during construction and precautions and restrictions implemented if disturbance is indicated to monitored nesting and foraging sites.

Response: The Federal and non-Federal sponsor would like to discuss the specifics of this request with the FWS before concurring or not concurring with this recommendation. Restricting noise levels to below 40dBA is not realistic for *construction machinery. Heavy equipment such as that used to build levees, excavate or move large quantities of earth, cannot meet this standard.*

Wood Stork

11. The wood stork may forage in marshes and canals within and adjacent to the C-111 SC Project site and project study area. The FWS recommends that the project sponsors adhere to the guidelines found in Habitat Management Guidelines for the Wood Stork in the Southeast Region for construction-related actions (Ogden 1990) (Appendix D). Specifically, there should be no disturbance to feeding sites when storks are present. This would include guidelines for noise disturbance discussed above for Everglade snail kite. Construction related activity should be no closer than 300 ft when a solid vegetation screen is present and no closer than 750 ft when there is no vegetation screen.

Response: The Federal and non-Federal sponsor would like to discuss the specifics of this request with the FWS before concurring or not concurring with this recommendation.

Cape Sable Seaside Sparrow

12. Prior to initiating project operations, further analysis of project effects on hydrologic conditions in Cape Sable seaside sparrow critical habitat areas in subpopulations C and D should be conducted to facilitate preparation of operational flexibilities that consider sparrows and other species and habitat to maximize overall project benefits. These operations could be related to specific trigger cells located at key locations at verified ground elevations. An operations schedule should be developed with consideration of project structure operations during time periods key to sparrow life history requirements.

Response: The analysis conducted to date has been extensive, predicted hydrologic changes less than natural variability, and we have agreed to include trigger based overrides during the nesting season. Attempts to further constrain operations in support of CSSS recovery goals would severely impinge on the projects overarching goal of restoring flows to Florida Bay via Taylor Slough.

13. Monitoring of hydroperiod, water depth and vegetative community composition needs to be an integral part of the baseline and post construction and operation ecological monitoring plan not only in sparrow habitat areas, but all areas of the project study area affected by hydrological changes.

Response: The monitoring described is contained within the Hydrometeorological and Ecological monitoring plans (Annex E).

14. Current survey data for occurrence of CSSS is providing valuable information and needs to be continued. This includes helicopter surveys being conducted by NPS along the existing grid network in all subpopulations, but specifically in subpopulations B, C, and D in the project study area.

Response: Both agencies conceptually support additional data collection, however limited project-level monitoring funding must be directed to the priorities outlined in the monitoring plan contained in Annex E. FWS' recommendation of continued CSSS surveys funded by ENP is outside the scope of this USACE-WMD sponsored project. The USACE already reserves about $1.4 million dollars every year for monitoring studies of CSSS and Everglade snail kite and their habitats, including habitats inside ENP.

15. Vegetation surveys similar to those conducted by FIU (Ross et al. 2003) should also be continued. These surveys include transects that include observations of vegetation, periphyton, soils, and topography. Figure 29 illustrates the location of the current vegetation transect being sampled in subpopulation D. Due to the anticipated changes of the project indicated by model output, the survey transects for vegetation surveys in subpopulation D should be expanded to increase coverage in areas that will be impacted by hydroperiod changes as well as to better monitor areas currently being used by CSSS. Figure 29 also illustrates the additional transect locations that are recommended in subpopulation D. These additional transects should be surveyed annually.

Response: Noted. USACE supports the cited Ross study under the 2006 Biological Opinion for IOP. There is no need to tie this operation-related monitoring to a CERP project as it is already ongoing under a multi-year contract tied to system operations.

16. Due to the anticipated changes indicated by model output for the project, vegetation surveys should be expanded to areas outside the critical habitat that model output indicates will be affected by hydroperiod changes potentially beneficial to sparrows, in addition to monitoring areas that may currently be utilized by CSSS. These surveys should include transects that include observations of vegetation, periphyton, soils, and topography.

Response: As stated above, the Corps is already providing funding for the existing vegetation monitoring effort. Funding is provided by O&M (Operating) funds and RECOVER. RECOVER does not anticipate an increase in their monitoring budget; therefore, any augmentation of the present monitoring may require an alteration of sampling station locations to include areas outside of critical habitat.

17. The U.S. Geological Survey, EVER4 water level gauging station is centrally located in subpopulation D critical habitat and can continue to be used for monitoring purposes. Historical data provided by the gage compared to Modbranch model output does not indicate a reliable and consistent association. Examination of field conditions and ground elevation at the gage compared to other habitat areas in subpopulation D suggests that additional monitoring points are needed to sufficiently characterize and monitor habitat conditions needed by the CSSS in subpopulation D. Additional water level gauging stations need to be established with daily output of stage to be used to better establish the relationship with the existing EVER4 station as well as for adaptively managing and calibrating project operations to minimize effects on CSSS. Figure 30 shows the recommended locations for these additional water level gauging stations.

Response: Placement of additional water level gauges or other suggested monitoring parameters should be coordinated through the refinement of the Interim Operating Plan and BO. CSSS monitoring as presented in the Ecological Monitoring Plan in Annex E.

18. Critical habitat in the project study area should have extensive ground elevation surveys performed to facilitate a better understanding of sparrow habitat conditions and project operations as well as enhancing the ability to protect important sparrow habitat.

Response: As stated above, additional monitoring parameters should be coordinated through the refinement of the CSSS monitoring protocols as developed in the Ecological Monitoring Plan (Annex E).

19. Ground tracking and banding surveys that have been conducted for sparrows in the project study area (Lockwood et al., 2006) should be continued for critical habitat within the project study area and possibly expanded to areas that are indicated by model output will possibly exhibit hydrologic conditions conducive to the sparrow.
Response: We take this as an expression of the Service's scientific opinion, but this work occurs in ENP and is not currently funded by either USACE or SFWMD. USACE already is funding over $1 million dollars in monitoring for the sparrow and snail kite. The share of all agencies in the endangered species monitoring for the sparrow was worked out in a high-level interagency meeting among the FWS, other DOI agencies and the Corps in Shepherdstown, W. VA, in 2000. If the Service is proposing a change in cost-share for overall funding of all monitoring for C&SF Operations, this should be discussed above project level by our respective directors. Both agencies conceptually support additional data collection, however limited project-level monitoring funding must be directed to the priorities outlined in the monitoring plan contained in Annex E.

20. The Corps and District should prepare and implement a Cape Sable seaside sparrow management plan for the C-111 SC Project study area in consultation with the Service that would include identification of potential sparrow habitat expansion both within and outside of designated critical habitat areas, recommended management and monitoring, and other possible habitat enhancement measures both within critical habitat and in potential expansion areas. The management plan would include measures such as woody vegetation removal, fire management, and creation of sawgrass refugia.

Response: The Federal and non-Federal sponsor would like to discuss the specifics of this request with the FWS before concurring or not concurring with this recommendation. If the Service proposes changing the overall monitoring and cost-share for same within the BO requirements, that should be discussed in a different forum.

Eastern Indigo Snake

21. The eastern indigo snake may be present in and around the construction area for this project. The Corps should comply with the Standard Protection Measures created for the eastern indigo snake (Appendix E). Standard Protection Measures include the development and implementation of an eastern indigo snake protection and education plan for all construction personnel to follow. This plan should be submitted to the FWS for review and approval at least 30 days prior to the commencement of any construction activity. Informational signs should also be posted throughout the construction site and along any proposed access roads to alert construction personnel to the likely presence of this species. These signs should contain a description of the snake, its habits and protection under Federal law; instruction not to injure, harm, harass or kill this species; directions to cease activity to allow the snake sufficient time to move away from the activity; and telephone numbers of pertinent agencies to be contacted if a dead snake is encountered. If a dead snake is found, it should be covered in water and then frozen. In addition to the protection and education plan, an eastern indigo snake monitoring program should be submitted to the Service's South Florida Ecological Services Office in Vero Beach within 60 days of the conclusion of construction activities. This report should be submitted whether or not eastern indigo snakes are encountered.

Response: The Federal and non-Federal sponsor would like to discuss the specifics of this request with the FWS before concurring or not concurring with this recommendation.

American Crocodile

22. Because of the possibility of crocodiles nesting or being present in the project area, and because vehicular traffic will temporarily increase during project construction, which may affect crocodiles if they are present, pre-construction crocodile surveys are requested for this project. At this time, the Service has no formal written guidelines to reduce construction-relate effects on crocodiles. However, if crocodile nesting is observed, the Service will work with the Corps and District to outline reasonable measures to avoid disturbing or injuring crocodiles.

Response: The Federal and non-Federal sponsor would like to discuss the specifics of this request with the FWS before concurring or not concurring with this recommendation.

Other Wildlife Species

23. Prior to and during construction activities, the project site should be surveyed for the occurrence of State listed species of special concern such as the burrowing owl and gopher tortoise, which could potentially be found on canal banks and road berms. If state listed species are found, protective measures should be taken as directed by FWC. Similar surveying and protection protocol should be implemented for wading birds, such as the roseate spoonbill, little blue heron, snowy egret, tricolored heron, white ibis, Florida sandhill crane, and limpkin in feeding and nesting areas that may be disturbed within and adjacent to the C-111 SC Project site and project study area.

Response: The Federal and Local Project Sponsors intend to continue coordination with the FWC to identify all monitoring requirements necessary to avoid impacts to state listed species.

24. The removal and control of invasive non-native plant species is important to the success of this project. The Service recommends that sufficient project assets be provided for the initial physical or chemical removal of non-native vegetation. Changes in hydrology resulting from the project should contribute substantially to the control of non-native vegetation, but initial removal of mature stands will be required. Removal and control of invasive non-native vegetation also influences the survival and well-being of the listed plant species in the project area.

Response: Concur. The removal of exotic species is planned within the project area. Controlling and managing exotic vegetation on project lands after construction would be implemented as part of normal land management operations, and would be consistent with the overall CERP exotic vegetation management program.

25. The Service recommends that an invasive non-native species management plan be implemented as part of the Tentatively Selected Plan. This management plan should have four components: (1) construction practices that reduce the spread of the non-native plants; (2) initial aggressive treatment and management of substrates that are bared by restoration activities; (3) monitoring of non-native vegetation, and (4) extensive site management activities by the land manager, including controlled burns. Without such a plan, invasive non-native vegetation would re-infest the project area, particularly the construction areas, reducing the benefits of the action.

Response: Details regarding practices to reduce the spread of non-native plants will be contained within the project specifications. Monitoring and site management activities, such as controlled burns, will be conducted as part of normal land management operations, and would be consistent with the overall CERP exotic vegetation management plan.

A.3 PLANNING AID LETTERS

US Fish and Wildlife Service – December 16, 2002
US Fish and Wildlife Service – September 30, 2003
US Fish and Wildlife Service – February 12, 2004
US Fish and Wildlife Service – March 24, 2005
US Fish and Wildlife Service – November 22, 2005

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

December 16, 2002

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

RE: Scoping Notice and Planning Aid Letter
for C-111 Spreader Canal Project,
Miami-Dade County

Dear Mr. Duck:

The Fish and Wildlife Service (Service) provides the following comments with regard to the U.S. Army Corps of Engineers' (Corps) May 7, 2002, notice soliciting input on issues to be considered as the Corps develops its National Environmental Policy Act analysis of the C-111 Spreader Canal. This letter is also provided as a first Planning Aid Letter (PAL) in accordance with the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and section 7 of the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This PAL does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA.

The purpose of the C-111 Spreader Canal Project is to improve the freshwater quality and restore sheet flow to the Model Lands, Southern Glades Wildlife and Environmental Area (SGWEA), and Everglades National Park (ENP). In addition, restoring freshwater sheetflow would reduce the unnatural variations in salinity that northeastern Florida Bay, Manatee Bay, and Barnes Sound have experienced due to the construction and operation of the C-111 canal system. The Service believes that the C-111 Spreader Canal Project has the potential to greatly benefit the fish and wildlife resources of the lower C-111 basin. The reintroduction of sheetflow will help reestablish freshwater marshes, particularly those north of Barnes Sound, that have become saline due to rerouting discharges through the C-111 system. We anticipate that the reintroduction of sheetflow, as opposed to point-source discharges, will also help reestablish stable benthic communities in the nearshore areas of Barnes Sound. Improvements in timing and distribution will benefit wading birds, such as the roseate spoonbill (*Ajaia ajaia)*, that rely on spring recessions in the southernmost reaches of the Everglades, and improve crocodile nesting and juvenile survival.

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Operational History

The construction of a spreader canal in the southern C-111 basin was initially proposed under the 1994 Final Integrated General Reevaluation Report (GRR) and Environmental Impact Statement for the Canal-111 (C-111) Project. This GRR continued restoration and flood control efforts initiated by the 1989 C-111 Interim Plan and proposed additional modifications to the Central and South Florida (C&SF) Project. These modifications included construction of an east-west spreader canal, construction of the S-332E pump station to move water into the new spreader canal, plugging the C-109 and C-110, and removing spoil mounds in the lower C-111 system to increase freshwater flows to the panhandle of ENP and Florida Bay. Specifically, the GRR proposed to divert freshwater from the lower C-111 system to the east into the SGWEA and Model Lands and south into the marshes of the park.

Portions of the GRR plan have been completed. These include the removal of 54 spoil mounds along the southern bank of the lower C-111 and the backfilling of the C-109 canal, required of the Florida Department of Transportation as mitigation for road development along U.S. Highway 1.

Existing Conditions

The lower C-111 basin lies southeast of the Miami Rock Ridge and is isolated from direct surface water flows from the Everglades by a series of roads and flood-control canals. The lower basin is comprised primarily of undeveloped wetland. Elevations of the low, flat terrain are generally less than one meter above sea level but are significant in hydrologic model development and confidence. Approximately 80 percent of the land in the South Dade Wetlands Area has not been anthropogenically disturbed, and areas with disturbance have generally been limited to hydrologic changes. Historic farming and associated rock plowing constitute the greatest physical change to the land. Undeveloped areas contain predominantly wetland vegetation. Federally and State-listed wildlife is known or anticipated to occur within the project area. Many listed species utilize the wetlands for life cycle events such as feeding, foraging, nesting, and breeding.

Extreme hydroperiod events have changed the structure and function of this once hydrologically connected basin. Over-drainage has shortened hydroperiods in the marshes adjacent to C-111. This change has displaced the historic function of the lower basin wetlands and has provided recruitment opportunities for exotic plants and animals. Stabilizing and restoring basin hydroperiod would aid in the protection and recruitment of habitat for listed species, including the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*).

A predominantly red mangrove (*Rhizophera mangle*) transitional community exists along the project's southern boundary. This transitional zone is an important ecosystem component of

Florida Bay and the C-111 lower basin. There is significant overlap in species use between the two basins, but this transition zone offers refugia for a potentially different suite of fauna than do the freshwater wetlands of the lower C-111. Restoring the quality, quantity, timing, and delivery of freshwater flows would change the salinity levels of this zone, thus changing its floral and faunal components. In addition, the brackish water would ultimately enter the Florida Bay system, thus having a benefit to species utilizing the seaward component of this zone. The species that is Federally listed and potentially most likely to benefit is the American crocodile (*Crocodylus acutus*).

The estuarine systems of Manatee Bay, Florida Bay, and Barnes Sound have been impacted by the development and operation of the C-111 canal, pumps, and staging structures. Changing the timing and delivery of fresh water has altered historic salinity levels in these estuarine settings. Declines in fish catches and productivity in northeastern Florida Bay and Barnes Sound may be associated with highly variable salinities due to the altered freshwater deliveries. The restoration of sheetflow and the elimination of point-source discharges of fresh water would decrease extreme saline events within the estuarine setting of the C-111 project area. The change should enhance juvenile crocodile development, which is dependent on stable salinity levels, support the recruitment of seagrass communities, and enhance fish productivity.

Water quality of the lower C-111 basin has been compromised by upstream pollution loads and changes in water delivery. These changes have enabled the spread of exotic species and created an imbalance in species diversity. Developing water quality targets for a newly designed hydrodynamic model and designing a stormwater treatment area (STA) to treat pollution should improve water quality and help restore marsh and estuarine systems of the lower C-111 basin.

Project Description

The C-111 Spreader Canal Project as proposed under the Comprehensive Everglades Restoration Plan (CERP) includes levees, canals, pumps, water control structures, and an STA to be constructed, modified, or removed in the Model Lands and Southern Glades area of Miami-Dade County to provide water deliveries that would enhance the connectivity between the natural areas present in the Southern Glades and the Model Lands. The pump and spreader canal features will be designed and operated to allow a hydrologic reconnection of the natural areas similar to historic ranges. Ultimately, the project provides a more natural sheetflow pattern to Florida Bay by eliminating point sources of freshwater discharge through C-111 to the estuarine systems of Manatee Bay and Barnes Sound. To improve habitat function and quality, improve native plant and animal species abundance and diversity, and to reserve sufficient water for the restoration of the natural system, the following design features have been identified:

- Construction of the spreader canal (location to be determined);
- Enlargement of the S-332E pump station to 500 cfs;

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- Backfilling the C-111 and C-110 canals;
- Removal of water-control structures S-18C and S-197;
- Design and construction of an STA;
- Construction of a culvert system under U.S. Highway 1 and Card Sound Road; and
- Acquisition of lands needed to construct the STA and the spreader canal system.

The approved Project Management Plan identifies these features as necessary to restore the lower C-111 basin; however, the location and development impact of these features will need to be identified during project planning.

Project Enhancements

1. **Model Development**

Because the South Florida Water Management Model (SFWMM) provides output that averages topography over a two-mile by two-mile grid cell, and because we understand that its output is not as reliable at the model boundaries, the SFWMM is not a likely candidate for assessing alternatives for the C-111 Spreader Canal Project. Instead, we believe that it will be necessary to use a finer-scale model that can capture the hydrologic effects of operating alternatives over a topographically heterogeneous environment such as that found in the lower basin setting. Developing a new model is an option if existing models cannot perform the sub-regional analysis.

2. **Performance Measures**

Performance measures and targets are required to evaluate predictions of hydrologic conditions provided by any existing or proposed hydrodynamic models. We recommend the suite of performance measures include, at a minimum:

- Water quality components;
- Obligate native wetland plant species cover, recruitment, and type in the C-111 lower basin;
- Higher trophic level species needs, including observed and expected use by Federally and State-listed species;
- Temporal and spatial changes in saline- and freshwater-induced hydric soils;
- Recruitment of both saline- and freshwater-induced hydric soils;
- Exotic plant and animal species recruitment and abatement; and
- The temporal and spatial change and recruitment of different native habitat types including mangrove, estuarine benthic assemblages, and sawgrass (*Cladium jamaicensis*) wetlands.

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3. Federally and State-Listed Species
Table 1 identifies several Federal and State listed species that are either known or anticipated to occur within the project area. This PAL provides the following information for planning purposes only; it does not constitute the official list for ESA purposes.

Table 1

Common Name	Scientific Name	Listing Status	Principle Listing Agency
Birds			
Cape Sable seaside sparrow*	*Ammodramus maritimus mirabilis*	Endangered	Federal
Wood stork	*Mycteria americana*	Endangered	Federal
Everglade snail kite*	*Rostrhamus sociabilis plumbeus*	Endangered	Federal
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Federal
Roseate tern	*Sterna dougallii dougallii*	Threatened	Federal
Arctic peregrine falcon	*Falco peregrinus tundrius*	Endangered	Florida
White-crowned pigeon	*Columba leucocephalus*	Threatened	Florida
Least tern	*Sterna antillarum*	Threatened	Florida
Piping plover	*Charadrius melodus*	Threatened	Florida
Limpkin	*Aramus guarauna*	Special Concern	Florida
Little blue heron	*Egretta caerulea*	Special Concern	Florida
Tricolored heron	*Egretta tricolor*	Special Concern	Florida
Snowy egret	*Egretta thula*	Special Concern	Florida
Roseate spoonbill	*Ajaia ajaja*	Special Concern	Florida
Reddish egret	*Egretta rufescens*	Special Concern	Florida
White ibis	*Eudocimus albus*	Special Concern	Florida
Brown pelican	*Pelecanus occidentalis*	Special Concern	Florida
Black skimmer	*Rynchops niger*	Special Concern	Florida
Reptiles			
American crocodile*	*Crocodylus acutus*	Endangered	Federal
Eastern indigo snake	*Drymarchon corais couperi*	Threatened	Federal
Miami black-headed snake	*Tantilla oolitica*	Threatened	Florida
American alligator	*Alligator mississippiensis*	Special Concern	Florida
Mammals			
West Indian manatee*	*Trichechus manatus*	Endangered	Federal
Florida panther	*Puma concolor coryi*	Endangered	Federal
Everglades mink	*Mustela vison evergladensis*	Threatened	Florida
Florida mastiff bat	*Eumops glaucinus floridanus*	Endangered	Florida

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Common Name	Scientific Name	Listing Status	Principle Listing Agency
Birds			
Fish			
Key Silverside	*Menidia conchorum*	Threatened	Florida
Mangrove rivulus	*Rivulus marmoratus*	Special Concern	Florida
Invertebrates			
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	Endangered	Federal
Florida Tree snail	*Liguus fasciatus*	Special Concern	Florida
Plants			
Tiny polygala	*Polygala smallii*	Endangered	Federal
Crenulate lead plant	*Amorpha crenulata*	Endangered	Federal
Garber's spurge	*Chamaesyce garberi*	Threatened	Federal

(*critical habitat designated for this species)

There may be additional Federally listed species that potentially occupy the study area, but are unknown at this time. In addition, the project area includes areas of designated critical habitat for the Cape Sable seaside sparrow, American crocodile, West Indian manatee, and Everglade snail kite. The State of Florida does not designate critical habitat for its listed species. In order to manage for the numerous listed species known or anticipated to occur within the project area, the Service supports objectives and strategies that restore the hydrology of the lower C-111 basin.

4. Exotics

The spread of exotic plants and animals in the lower C-111 basin has been facilitated by a change in historic water delivery schedules. The new C-111 spreader canal operational plans for pumping systems, STAs, and water deliveries through spreader canals should be designed to control for the continued spread of exotics. As an example, installation of exotic-control devices on proposed pump stations should reduce the spread of exotic fish in the study area.

5. Improving Water Quality

High levels of phosphorus and certain pesticide concentrations are chronic pollution inputs to the lower C-111 basin.

Phosphorus. The basin receives water from S-178 on the C-111 E canal that, according to ENP correspondence, presents the highest total phosphorous (TP) concentrations (24 ppb) of any structure in the C-111 basin (Pfeuffer 1998). An increase in groundwater flow is proposed from ENP into Taylor Slough through S-332D, potentially reducing water availability to the lower C-

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111 basin. Reducing the water availability in the lower C-111 basin will also reduce the dilution rate of total phosphorus (TP) in the lower basin, thereby an imbalanced composition of native flora and fauna. To manage for a balanced composition of native species, the proposed STA should be designed to accommodate the potential increase in TP concentrations.

Pesticides. S-178 is part of the South Florida Water Management District's (SFWMD's) Pesticide Monitoring Network. The water and sediment samples collected from S-178 contain atrazine, DDT and its metabolites, endosulfan and its metabolites, and metalaxyl. Endosulfan is used extensively in the agricultural settings and high values are routinely found during the growing season. Endosulfan has also been recorded in Florida Bay (Florida Department of Environmental Protection 1997). In order to reduce the pesticide load, the proposed STA should be designed to remove these pesticides. In addition, pesticide levels that enter the system must meet a maximum threshold as established through hydrodynamic model performance measures. The system should neither produce nor accept resources that exceed established water-quality targets.

6. Hazardous, Toxic, and Radioactive Waste (HTRW) Assessment
A Level I and, possibly, a Level II environmental site assessment may be needed in the area due to past agricultural practices. The SFWMD is working with the Service to establish a protocol for contaminants evaluation on CERP-related lands to determine if risks to fish and wildlife exist. We recommend that HTRW activities include coordination with the Service's staff in its Environmental Contaminants Program, which can provide technical assistance. Service involvement with HTRW sampling procedures, especially early in the developmental stages, will ensure that the Service's concerns are taken into account regarding Environmental Site Assessments. In addition, there appears to be a limited amount of fill to backfill the lower C-111 and the C-110 canals. Any fill from other locations should also undergo a similar level of HTRW assessment.

7. Placement of the STA
The Service supports the development of an STA to treat upstream flows proposed by the Combined Structural and Operational Plan; however, its size and location in the landscape should minimally disturb native floral and faunal communities. As proposed, the STA is in an area of high quality Everglades marl prairie habitat actively managed by Florida Fish and Wildlife Conservation Commission as the SGWEA. For this reason, alternative sites should be investigated. In addition, its hydroperiod should be adjusted to minimize the methylation of atmospherically deposited and hydrologically transported mercury. In order to assist in STA project planning, the Service is in the process of developing recommendations about the beneficial and adverse effects of STAs. These recommendations will be made available once completed.

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8. Location of the Spreader Canal

The Service recommends building the spreader canal along the paved road that defines the northern boundary of SGWEA. An alternative choice is to build the canal along the old agriculture road located south of the paved road. Either of these alternatives would reduce impacts to habitat when compared to building the canal due east of the junction of C-111 and C-111E, a situation that would significantly impact more wetland habitat. A third alternative is to build the canal along the southern boundary of the rock mine located between U.S. Highway 1 and Card Sound Road. As is the case of the STA, the proposed alignment of the spreader canal could affect the SGWEA. It should be located and designed such that the SGWEA is not hydrologically isolated by the levee to the north of the canal.

Additionally, the location of the canal should be coordinated with the construction of the U.S. Highway 1 improvements. These improvements are proposed to fill in many acres of wetlands within the C-111 basin. Culverts, bridges, and other roadway design requirements may impact the function of the proposed spreader canal and play a role in its location.

9. Backfilling the C-111 and C-110 Canals

The PMP proposes to backfill both the lower C-111 canal and portions of the C-110 canal. The reconnection of lands separated by the C-111 and C-110 will increase overland movement opportunities for animals utilizing Units 1, 2, and 3 of the SGWEA. In addition, backfilling reproduces a sheetflow setting that approaches historic flow patterns. This action improves hydrodynamic functions of the SGWEA, enabling the restoration of downstream estuarine systems including Floirda Bay, Manatee Bay, and Barnes Sound.

10. Capacity of the S-332E Pump

The PMP proposes the construction of the S-332E pump station at a capacity of 500 cfs to discharge water from the STA through the new spreader canal and, ultimately, to the Model Lands. The pump should be sized for flood control for agricultural and residential lands upstream, while providing for the restoration objectives mandated by CERP.

11. Interdependencies with Other CERP Projects

Because improving the delivery of fresh water is a key component of the restoration of Florida Bay, Barnes Sound, and Biscayne Bay and its coastal wetlands, we recommend that the development of the C-111 Spreader Canal Project be closely coordinated with the Florida Bay/Florida Keys Feasibility Study (FBFKFS), the Biscayne Bay Feasability Study (BBFS) and the Biscayne Bay Coastal Wetlands Project. To date, draft performance measures and the project footprint have been established for FBFKFS; these performance measures should be approved within the next six months. They should be reviewed and included, to the maximum extent practical, in the modeling and design components of the C-111 Spreader Canal Project. Targets for the lower C-111 basin hydrodynamic performance measures must be coordinated with the BBFS hydrodynamic modeling efforts. Surface water inputs should not contradict but contribute

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to those designed for the BBFS. The restoration objectives of Draft performance measures and a project footprint have not yet been developed for the Biscayne Bay Coastal Wetlands Project, but when these are developed, they should similarly be coordinated with the C-111 Spreader Canal Project. At issue is whether there is enough water for this project to deliver to meet the restoration objectives of the Florida Bay and Biscayne Bay project objectives, while still restoring the lower C-111 basin.

12. Interdependencies with Other Projects
This project has the potential to improve wetland function of two mitigation banks: Florida Power and Light's Everglades Mitigation Bank and the RMC South Florida, Inc., mitigation bank. Mitigation banks are designed to replace the loss of offsite wetlands caused by various forms of development. Therefore, coordination with all Corps permit requirements addressed by section 404 of the Clean Water Act will be required to ensure that C-111 Spreader Canal restoration benefits are not credited as improvements under the mitigation bank criteria.

In addition, private development projects within the project area will have an impact on the restoration of the lower C-111 basin as well. Private land development opportunities should be identified and impacts assessed in order to ensure project success.

13. Wildlife Underpasses
The fact that the C-111 Spreader Canal, as proposed under CERP, extends east of U.S. Highway 1 and Card Sound Road makes the establishment of habitat connectivity for fish and wildlife under U.S. Highway 1 possible. Accordingly, we recommend that the project planning process investigate the feasibility of establishing wildlife underpasses on either side of U.S. Highway 1. In addition, recreational opportunities such as fishing and hiking, potentially lost as a result of filling the existing canal and removing the existing C-111/U.S. Highway 1 bridge, would be enhanced with a well-designed footpath under each road.

Summary

We submit this PAL as a first step in supporting this important Everglades restoration project, and are looking forward to continuing to work collaboratively to ensure its success. We are optimistic that the C-111 Spreader Canal Project can do much to reverse decades of damage experienced by the freshwater marshes of southern Miami-Dade County and the nearshore environment of Card Sound, Barnes Sound, and northeastern Florida Bay. Further, we are pleased to note that this project has a potential role in the recovery of the endangered crocodile, as well as in improving conditions for the entire suite of species that rely on habitats typical of the transition from freshwater marsh to nearshore marine systems. We remain committed to assist with project implementation and hope these recommendations help the PDT to further

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enhance fish and wildlife resources in the lower C-111 basin. If you have any questions, please feel free to contact Bill Miller at (305) 872-2753 or Kevin Palmer at (772) 562-3909, extension 280.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
SFWMD, West Palm Beach, Florida (Art Sengupta)
SFWMD, West Palm Beach, Florida (Dewey Worth)
Corps, Jacksonville, Florida (Barbara Cintron)
Corps, Jacksonville, Florida (Charles Fales)
Corps, Jacksonville, Florida (Jill Tefts)
FWC, Vero Beach, Florida (Joseph Walsh)
Service, Jacksonville, Florida (Miles Meyer)

Literature Cited

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Florida Department of Environmental Protection. 1997. A Preliminary Evaluation of Water Quality in the C-111 Canal Basin; West Palm Beach, Florida.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20[th] Street
Vero Beach, Florida 32960

September 30, 2003

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Attention: Janet Cushing

Dear Mr. Duck:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the C-111 Spreader Canal Project in accordance with the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*), and the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This letter does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. The purpose of this PAL is to provide a summary of the Service's current assessment of the potentially most extensive effects, both positive and negative, of the footprint of this project to species listed by the Federal government as endangered or threatened. If designated critical habitat could be altered, we have noted that as well. Future PALs will provide a list of potentially affected State-listed species, a preliminary study area, and a description of the major habitat types that currently exist in the study area.

I. Introduction

The U.S. Army Corps of Engineers (Corps) and the Service coordinate to conserve, protect, and enhance fish, wildlife, and plants and their habitats. Natural resource protection legislation relevant to this project include the ESA, the FWCA, the National Environmental Policy Act (NEPA), as amended (42 U.S.C. 4321 *et seq.*), and the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712). In addition, several Executive Orders have also established guidance to Federal agencies, including the Service, relative to fish and wildlife protection and conservation. For projects authorized under Water Resources Development Act, the ESA and the FWCA represent the primary authorities under which the Service cooperates and coordinates with the Corps and their project sponsors. We are committed to contributing scientific and technical guidance in the areas of ecological and biological assessment and environmental risk assessment throughout this process.

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II. Project Description

The CERP C-111 Spreader Canal Project includes levees, canals, pumps, water control structures, and a Stormwater Treatment Area (STA) that will be constructed, modified, or removed in the Model Lands and Southern Glades (C-111 Basin) area of Miami-Dade County. The C-111 Spreader Canal Project enhances the C-111 General Reevaluation Report design with the following proposed features:

- Design and construct a new STA
- Increase the capacity of pump station S-332E to 500 cfs
- Extend the spreader canal under U.S. Highway 1 (U.S. 1) and Card Sound Road
- Place culverts under U.S. 1 (part of Florida Department of Transportation road work)
- Backfill C-110
- Fill C-111 between S-18C and S-197
- Remove S-18C and S-197
- Acquire lands needed to construct the STA, spreader canal system and to protect lands affected by hydrologic improvements that will occur to the south of the lower C-111 and east of U.S. 1 in the Model Lands. Preliminary estimates indicate that a minimum of 6,100+ acres may be acquired.

III. Potential Effects on Federal Threatened and Endangered Species and Designated Critical Habitats

Cape Sable seaside sparrow

The Cape Sable seaside sparrow (CSSS) (*Ammodramus maritimus mirabilis*) has not been documented within the project footprint. Approximately 15,500 acres of designated CSSS critical habitat are within the area likely influenced by the C-111 Spreader Canal Project. Backfilling the lower C-111 canal would likely impact 62 acres within the canal and levee bank corridor that borders this critical habitat area. Since the canal and levee bank corridor do not represent preferred habitat for the CSSS, the 62-acre backfill will not be counted as an impact. However, CSSSs have been documented in the vicinity of the lower C-111 canal as recently as surveys in 2000. Equipment activity and noise during backfill activities have the potential to create a temporary disturbance to CSSS in that area. The Corps has agreed to implement measures to avoid adverse effects due to construction disturbance; therefore, no adverse effects are expected. The STA and C-111 spreader canal footprints will not directly impact CSSS.

Wood stork

None of the footprint acreage for the C-111 Spreader Canal Project is within the primary or secondary nesting zones for known wood stork (*Mycteria americana*) colonies (as detailed in the

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Service's *Standard Local Operating Procedures for Endangered Species* [SLOPES] for Wood Storks). The Wood Stork SLOPES provide the user with a stepwise process to determine if the proposed action will affect wood storks, what effect will the action have on wood storks, and options available that may avoid or minimize the action's effects to wood storks. The C-111 Spreader Canal Project area is suitable foraging habitat for wood storks and within the maximum 18.6-mile core foraging area of documented nesting colonies outside the project area. Almost all of the freshwater marsh and estuarine areas in the C-111 Spreader Canal Project can be considered suitable wood stork foraging habitat. Construction of the C-111 spreader canal will convert approximately 236 acres in the sawgrass and tree island vegetation zone to deeper, open-water habitat not suitable for wood stork foraging. Conversely, the proposed backfill of the C-111 and C-110 footprint would benefit the wood stork by converting an estimated total of 529 acres of deeper, open-water habitat and levee banks in the canal system to shallower, shorter hydroperiod wetlands that would offer seasonal foraging habitat. This level of impact assumes complete leveling and backfilling of the canal and levee system to a level similar to surrounding habitat conditions, a return to a more natural sheetflow condition, and recovery of native marsh vegetation. Suspended sediment created by construction from either removal of the existing levee or construction of the C-111 spreader canal and which is allowed to run off the levee could impact prey species for wood storks. However it is assumed that sediment barriers will be properly used during construction and no effect on visibility of stork prey items will be caused by siltation. The Service's *Habitat Management Guidelines for the Wood Stork in the Southeast Region, U.S. Fish and Wildlife Service Supplemental Habitat Management Guidelines for the Wood Storks In The South Florida Ecological Services Consultation Area* and Wood Stork SLOPES should be consulted during project planning.

The proposed STA footprint of 3,200 acres would replace an estimated 1,088 acres of shrub-dominated freshwater marsh and 2,112 acres in sawgrass and tree islands with flooded wetland habitat of varying depths. Observations of wood stork utilization of STAs in other areas are encouraging, but operating criteria for the STA will determine final wood stork usage. For purposes of this analysis, STAs are not expected to provide reliable habitat and will not be counted as stork habitat.

An estimated 0.4 acre of roadside fringe foraging habitat impacted by culvert installation along U.S. 1 would cause a small negative effect on wood stork foraging habitat, but would be more than offset by the overall habitat benefits created by the hydrologic reconnection across the highway.

Everglade snail kite

No designated critical habitat for the Everglade snail kite (*Rostrhamus sociabilis plumbeus*) is found within the C-111 Spreader Canal Project area. Wetlands in the Everglades region supporting the snail kite include Taylor Slough and the C-111 basin west of U.S. 1. Construction

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of the C-111 spreader canal would convert approximately 236 acres in the sawgrass and tree island vegetation zone to deeper, open-water habitat not suitable for snail kite foraging except for a narrow band along the shoreline. The proposed backfilling of the C-111 and C-110 footprint would benefit the snail kite by converting an estimated total of 529 acres of deeper, open-water habitat in the canals to shallower, shorter hydroperiod wetlands that would offer seasonal foraging habitat. This level of impact assumes complete leveling and backfilling of the canal and levee system to a level similar to surrounding habitat conditions, a return to a more natural sheetflow condition, and recovery of native marsh vegetation. Suspended sediment created by construction from either removal of the existing levee or construction of the C-111 spreader canal that is allowed to run off the levee could impact prey species for snail kites. However it is assumed that sediment barriers will be properly used during construction and no effect on visibility of snail kite prey items will be caused by siltation.

The proposed STA footprint of 3,200 acres would replace an estimated 1,088 acres of shrub-dominated freshwater marsh and 2,112 acres of sawgrass with tree islands with flooded wetland habitat of varying depths. Snail kites have been observed to utilize STAs in other areas, but the operating criteria for the STA will determine usage of the area. For purposes of this analysis, STAs are not expected to provide reliable habitat and will not be counted as snail kite habitat.

The 0.4 acre of roadside fringe foraging habitat impacted by culvert installation along U.S. 1 would be insignificant and would be offset by the overall habitat benefits created by the hydrologic reconnection across the highway.

Eastern indigo snake

The eastern indigo snake (*Drymarchon corais couperi*) utilizes a wide variety of habitat types in southern Florida. Almost the entire C-111 Spreader Canal Project area can therefore be considered suitable indigo snake habitat except for deeper water areas such as canals, tidally influenced mangrove and estuarine areas, and roads. Construction of the C-111 spreader canal would convert approximately 236 acres in the sawgrass and tree island vegetation zone to a canal system that would include deeper open-water habitat not considered suitable for eastern indigo snakes. The canal system would include a narrow band along the shoreline and the canal banks that could be considered acceptable habitat. The acreage of the deeper water zone is estimated to be around 100 acres. In contrast, backfilling the C-111 and C-110 canals by pushing their associated levees back into the canals would create habitat in the case of filling the canals, but reduce habitat quality in the case of eliminating the levees. Assuming that the canal and levee system is restored to resemble the surrounding topography and assuming that native marsh vegetation recolonizes the project footprint, then 225 acres of habitat would be created by filling in the canals; however, 304 acres of upland habitat would be removed by degrading the levees and replaced by marsh habitat. Road mortality could occur if the existing levee is used for equipment access to the construction area during either removal of the existing levee and canal or

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construction of the C-111 spreader canal. The Service's *Standard Protection Measures for the Eastern Indigo Snake* should be implemented during project construction.

The proposed STA footprint of 3,200 acres would replace an estimated 1,088 acres of shrub-dominated freshwater marsh and 2,112 acres of sawgrass and tree islands with flooded wetlands of varying depths. Eastern indigo snakes have been observed to utilize STAs in other areas, but operating criteria for the STA will determine usage of the area. Assuming that the STA is constructed with multiple cells formed by levees that provide interspersed uplands, the STA for purposes of this analysis will be treated as acceptable eastern indigo snake habitat.

The 0.4 acre of roadside fringe foraging habitat impacted by culvert installation along U.S. 1 would be insignificant and would be offset by the overall habitat benefits created by the hydrologic reconnection across the highway.

Florida panther

The designated Primary Zone for Florida panther habitat encompasses a large portion of the C-111 Spreader Canal Project area including the existing C-111 canal and levee, the proposed C-111 spreader canal location, and the proposed STA location. The proposed STA footprint of 3,200 acres in its currently proposed location would replace an estimated 1,088 acres of shrub-dominated freshwater marsh and 2,112 acres of sawgrass and tree islands with flooded wetland habitat of varying depths that is not acceptable panther habitat. The STA also represents a significant barrier to continuity of panther habitat and panther movement from the core population farther west in Everglades National Park and Big Cypress National Park to the Model Lands habitat area west of the Turkey Point Power Plant cooling ponds. This level of impact is significant in terms of detrimental effects on Florida panthers in the C-111 Spreader Canal Project study area, so relocation of the STA should be given serious consideration by the C-111 Spreader Canal Project Project Delivery Team (PDT).

Construction of the C-111 spreader canal would convert approximately 236 acres in the sawgrass and tree island vegetation zone to a canal system that would include deeper, open-water habitat not considered suitable for Florida panthers. The acreage of the deeper water zone is estimated to be around 100 acres. In contrast, backfilling the C-111 and C-110 canals by pushing their associated levees back into the canals would create habitat in the case of filling the canals, but reduce habitat quality in the case of eliminating the levees. Assuming that the canal and levee system is restored to resemble the surrounding topography and assuming that native marsh vegetation recolonizes the project footprint, then 225 acres of habitat would be created by filling in the canals, but 304 acres of upland habitat would be removed by degrading the levees and replaced by marsh habitat. The combined effect of these two components of the C-111 Spreader Canal Project would have a net benefit in terms of acres affected.

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Bald eagle

No recent bald eagle (*Haliaeetus leucocephalus*) nesting activity has been recorded in the C-111 Spreader Canal Project area. Suitable foraging habitat for bald eagles does exist throughout the project area. Components of the project footprint such as creation of the C-111 spreader canal and the STA should result in positive habitat changes for bald eagles by creating 3,436 acres of large, open waterbodies and banks, but dependent on the availability of open water (no emergent vegetation) and suitable perch and nest sites. The proposed backfill of the C-111 and C-110 footprint would convert an estimated total 529 acres in the canals and levees to shallower, shorter hydroperiod wetlands that would probably not present substantial eagle habitat. New electrical lines would be needed associated with the installation of pumps near open-water and water control structures. The publication *Suggested Practices for Raptor Protection on Powerlines: The State of the Art in 1996* should be consulted for recommended measures to protect eagles from electrocution.

The 0.4 acre of marginal roadside fringe habitat impacted by culvert installation along U.S. 1 would cause a potential small negative effect on bald eagles, but would be more than offset by the overall habitat benefits created by the hydrologic reconnection across the highway.

American crocodile

Critical habitat designated for the American crocodile (*Crocodylus acutus*) (Service 1999) encompasses almost the entire C-111 Spreader Canal Project area except for the proposed STA location. Therefore, locations throughout the freshwater marsh and estuarine areas of the C-111 Spreader Canal Project can be considered suitable American crocodile habitat. Construction of the C-111 spreader canal would convert approximately 236 acres in the sawgrass and tree island vegetation zone (with probable scattered but undocumented acceptable habitat and use) to a canal system that would include deeper open water and canal banks that could be considered acceptable habitat based on documented crocodile usage. In contrast, the proposed backfilling of the C-111 and C-110 footprint would convert an estimated total 529 acres in the canals and levees to shallower, shorter hydroperiod wetlands that may have some scattered acceptable habitat.

The 0.4 acre of marginal roadside fringe crocodile habitat impacted by culvert installation along U.S. 1 would cause a small negative effect on crocodiles, but would be more than offset by the overall habitat benefits created by the hydrologic reconnection across the highway and the inclusion of three crocodile crossings in documented crocodile use areas.

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West Indian manatee

No designated critical habitat for the West Indian manatee (*Trichechus manatus*) is found within the footprint of the C-111 Spreader Canal Project area as currently proposed. Although manatees have historically been documented in the lower C-111 canal as far north as S-177, they do not currently have access north of S-197 from the lower C-111 canal. Manatees have infrequently been documented moving into the C-111 canal, apparently through the Lake Okeechobee system by way of the L-33, L-30, and L-31N canals. The proposed backfill of the C-111 canal under the current project proposal would end at S-197, leaving the lower C-111 canal from below S-197 to Manatee Bay unimpacted by construction. Currently, fresh water seeps into the C-111 canal below the S-197 structure, thereby attracting manatees. It is possible that backfilling the C-111 canal would reduce this seepage, thus making this part of the C-111 canal less attractive to manatees; however, this reduction may be offset once sheetflow is enhanced by the spreader canal. This issue warrants further investigation during project planning.

The impacts of the C-111 Spreader Canal Project on manatees outside the project footprint are as yet undetermined. In addition to the lower C-111 canal, manatees have been documented in the borrow ditches along Card Sound Road as far as 2 miles north of Barnes Sound and Little Card Sound. They have also been documented in the outlet canals from below the cooling canal matrix at the Turkey Point Power Plant down to Card Sound. Beneficial changes in wetland vegetation and freshwater flow due to the C-111 Spreader Canal Project supplying a more evenly distributed (spacial and temporal) source of freshwater (sheetflow) should be beneficial to manatees in these areas. The effect of water temperature changes on manatees from increased sheetflow also warrants further investigation.

IV. Other Comments

The C-111 Spreader Canal Project PDT as part of the initial planning process has been tasked to develop performance measures that will be used to assess impacts of project alternatives to various C-111 Spreader Canal Project study area resources including threatened and endangered species. In response to a request from the PDT, the enclosed performance measure for the Florida panther in the C-111 Spreader Canal Project study area is provided by the Service. It was developed in close cooperation with the C-111 Spreader Canal Project PDT, Ecological Sub-Team.

V. Closing Comments

The C-111 Spreader Canal Project has the potential to have broad-ranging effects on fish and wildlife resources. Furthermore, the C-111 Spreader Canal Project and several other CERP projects are closely associated, often with overlapping goals. The Service encourages close communication during all aspects of this project.

James C. Duck
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We appreciate this opportunity to provide planning guidance to the Corps on the C-111 Spreader Canal Project and look forward to continuing to provide technical support to the Corps during all phases of this important project. Please feel free to contact Richard Fike at 772-562-3909, extension 262, if you have any questions regarding this letter.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc:
Service, Jacksonville, Florida (Miles Meyer)
Service, Atlanta, Georgia (David Horning)
Corps, Jacksonville, Florida (Charles Fales)
SFWMD, West Palm Beach, Florida (Joanne Chamberlain)
SFWMD, West Palm Beach, Florida (Dewey Worth)
Florida Department of Environmental Protection, West Palm Beach, Florida (Herb Zebuth)
Biscayne National Park, Homestead, Florida (Sarah Bellmund)
Everglades National Park, Homestead, Florida (John Klochak)
Everglades National Park, Homestead, Florida (Mike Zimmerman)
FWC, Vero Beach, Florida (Dr. Joseph Walsh)
Miami-Dade County DERM, Miami, Florida (Dr. Susan Markley)
NOAA Fisheries, Miami, Florida (Dr. Joan Browder)

LITERATURE CITED

Service. 1999. South Florida Multi-species Recovery Plan. U.S. Fish and Wildlife Service Southeast Region. Atlanta, Georgia.

Enclosure

Performance Measure for the Florida Panther

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

February 12, 2004

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Duck:

The Fish and Wildlife Service (Service) has reviewed your letter received on December 16, 2003, requesting a list of threatened and endangered species and critical habitats that may occur within the C-111 Spreader Canal project area. We provide the following comments in accordance with section 7 of the Endangered Species Act of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). For future reference, we have assigned Service Log #4-1-04-I-6048 to this portion of the C-111 Spreader Canal project.

It is our understanding from the referenced letter and discussions with your staff that the U.S. Army Corps of Engineers intends to produce an Environmental Assessment on the alternatives to construct, modify, or remove levees, canals, pumps, and water control structures to reestablish a more natural water sheet flow pattern through the Model Lands and Southern Glades to Florida Bay, and may include a stormwater treatment area.

The Service concurs that species listed as endangered and that may be encountered in or adjacent to the project area include the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*), wood stork (*Mycteria americana*), American crocodile (*Crocodylus acutus*), Florida panther (*Puma concolor coryi*), West Indian manatee (*Trichechus manatus*), Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*), crenulate lead plant (*Amorpha crenulata*), and tiny polygala (*Polygala smallii*). The eastern indigo snake (*Drymarchon corais couperi*), bald eagle (*Haliaeetus leucocephalus*), roseate tern (*Sterna dougallii dougallii*), and Garber's spurge (*Chamaesyce garberi*) are listed as threatened and should also be included in the consultation. The Service does not normally include the American alligator (*Alligator mississippiensis*) in consultations because it is listed only due to similarity of appearance to the American crocodile. Additionally, critical habitat has been designated for the Cape Sable seaside sparrow, American crocodile, and West Indian manatee in the project study area.

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James C. Duck
February 12, 2004
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The Service acknowledges the time frame in which you would like to complete this consultation and will do everything possible to assist you in keeping this project on schedule. If you have any questions pertaining to this project, please contact Richard Fike at 772-562-3909, extension 262.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Service, Jacksonville, Florida (Miles Meyer)
Service, Atlanta, Georgia (David Horning)
Corps, Jacksonville, Florida (Todd Trulock)
Corps, Jacksonville, Florida (Janet Cushing)
District, West Palm Beach, Florida (Joanne Chamberlain)
District, West Palm Beach, Florida (Dewey Worth)
FDEP, West Palm Beach, Florida (Herb Zebuth)
Biscayne National Park, Homestead, Florida (Sarah Bellmund)
Everglades National Park, Homestead, Florida (John Klochak)
Everglades National Park, Homestead, Florida (Mike Zimmerman)
FWC, Vero Beach, Florida (Dr. Joseph Walsh)
Miami-Dade County DERM, Miami, Florida (Dr. Susan Markley)
NOAA Fisheries, Miami, Florida (Dr. Joan Browder)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

March 24, 2005

Dennis Barnett
Acting Chief, Planning Division
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Attention: Brad Tarr

Dear Mr. Barnett:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the C-111 Spreader Canal Project in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This letter does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA.

Introduction

The purpose of this PAL is to transmit the Service's contribution to the C-111 Spreader Canal Project narratives of future without project conditions for environmental, plant communities, and wildlife resources in the Feasibility Scoping Meeting (FSM) Conference document. This document contains information on the project background, existing and future without project conditions, problems and opportunities, goals and objectives, constraints and assumptions, management measures identified, and evaluation criteria used in the preliminary screening of alternatives. The information in this document will ultimately be part of the Project Implementation Report (PIR)/Environmental Impact Statement with additional information provided as the analysis proceeds. The FSM document provides the U.S. Army Corps of Engineers' (Corps) South Atlantic Division and Headquarters with a written briefing on project activities associated with the Corps' plan formulation process for the Comprehensive Everglades Restoration Plan (CERP) C-111 Spreader Project. The FSM document provides a summary of the technical and planning activities of the project in sufficient detail to allow a thorough review and determination in the FSM post-briefing Project Guidance Memorandum, that the C-111 Spreader Project is proceeding on track and no outstanding technical or policy issues remain that would inhibit preparation of the PIR.

TAKE PRIDE IN AMERICA

C-111 Spreader Canal Project, FSM Document, Future without Project; Environmental, Plant Communities, and Wildlife Resources

4.2 General Environmental Setting

Undeveloped areas contain predominantly wetland vegetation, plus disturbed, rural upland areas with roads, levees, and other man-made features. As a consequence of past and current water management practices, land development and sea level rise, freshwater wetlands in the project area have been reduced in areal extent, altered and degraded. Alteration of freshwater flow patterns and volumes have, in particular, reduced the occurrence of mesohaline, oligohaline, freshwater marshes, and sloughs, and have allowed the landward expansion of saltwater and mangrove wetlands, including low-productivity, sparsely vegetated dwarf mangrove communities, typical of the hypersaline or white zone.

The spatial extent of the natural areas within the project study area has the potential to change considerably through the year 2050. Those areas not currently in public ownership or in Public Lands Acquisition plans are likely to be developed. The general trend for developments near wetlands is for the residents in the area to request and obtain frequent mosquito spraying. Urbanization is accompanied by an increase in runoff of a wide range of pollutants including herbicides, pesticides, fertilizers, aromatic compounds (oils, gas), heavy metals, and other emerging pollutants of concern (hormones, organic, and inorganic compounds) (Figure 1). The increased release of pollutants into the natural environment would result in the decline of macroinvertebrates (insects, snails, etc.), which in turn would adversely impact migratory birds and other insectivores. Observations from field visits indicate the resident population in this area has high all terrain vehicle (ATV) usage, and this is likely to increase in the future without project scenario.

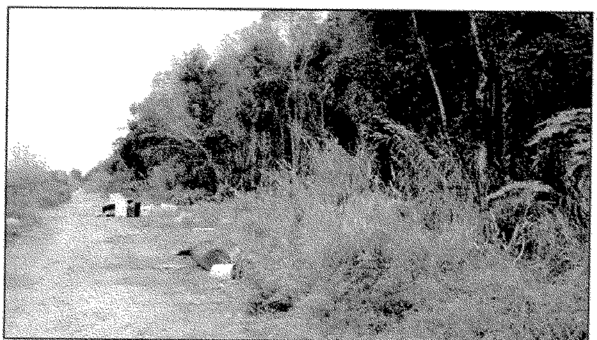

Figure 1: Occurrence of uncontrolled refuse dumping along access road bordering undeveloped land in Miami-Dade County

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Although there is current and near-future development planned for the area, the City of Miami will not provide solid waste disposal, with the result that some expanded refuse dumping will likely occur.

The future without project condition assumptions include the construction of the C-111 General Reevaluation Report features, which comprise a 50 cubic feet per second (cfs) pump with short spreader canal. Since a pump of this size is not large enough to fill the spreader canal, the canal would act a "sink," and in effect drain the wetlands to the north. The 50 cfs pump has been increased in capacity to 500 cfs in the C-111 Spreader Canal Project (Figure 2).

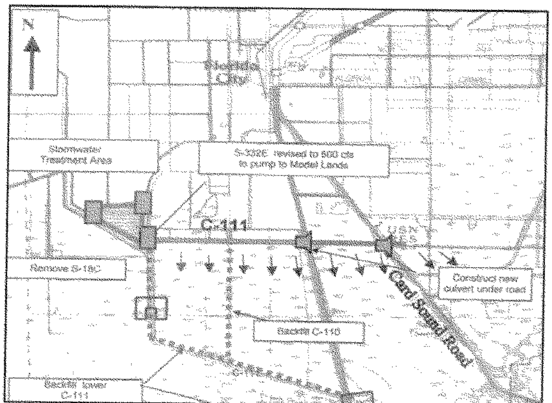

Figure 2: C-111 Spreader Canal Project "yellow book" alternative project components

4.3 Plant Communities

The section of Ecological Zone 2 (shrub-dominated freshwater marsh) east of Card Sound Road will not exist as a natural area. Future development would also have numerous secondary effects. The wetlands in the northern part of Ecological Zone 3 (sawgrass with tree islands) could transition from a sawgrass-dominated marsh to cattail-saltbush-dominated wetlands due to poor water quality from residential runoff and decline of available freshwater (Figure 3).

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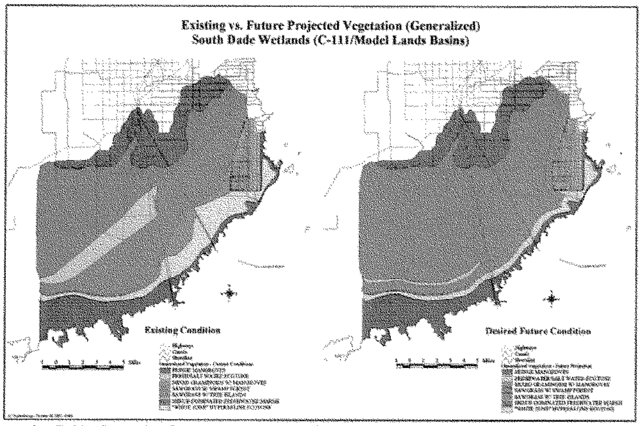

Figure 3: C-111 Spreader Canal Project vegetative zones

Changes in availability and distribution of freshwater and further disruption of natural sheet flow from discontinuities in hydrology due to levees, roads, canals, etc. will further exacerbate the changes occurring in the natural sawgrass, marl prairie, tree island, and mangrove ecotones. Sea level rise will create the potential for further expansion of salt tolerant plant species into the freshwater marsh areas. Disruption of natural fire cycles and extent can have several effects that will increase in the future without project scenario. Control of fire intensity and extent due to potential for impacts on human infrastructure can encourage establishment of woody plant species that would normally be eliminated as well as selection against more fire tolerant species such as sawgrass and muhly grass. Reduction of water availability can cause fires to burn more intensely than natural, killing plant species that would normally survive a more natural "cool burning" fire as well as permitting organic soils to burn. Concurrently, unnatural flooding can inhibit fires and beneficial vegetation changes. All of these processes will be exacerbated due to increased urbanization in the future. Due to land disturbance and projected lower water levels, invasive plant species, such as melaleuca (*Melaleuca quinquenervia*), Australian pine (*Casuarina* spp.), and Brazilian pepper (*Schinus terebinthifolius*), will become more widespread. With the lack of project monitoring and maintenance, there will also be an increase in other exotic plants including old world climbing fern (*Lygodium* spp.), and shoebutton ardisia (*Ardisia elliptica*).

Tree islands, an important component of the Everglades habitat for a variety of native plant species not adapted to growing directly in flooded marshes, are being variously impacted by changes in water management and invasion of exotic plant species. The future without project appears to offer little benefit to offset these ongoing detrimental effects.

The impacts resulting from unauthorized ATV usage in the natural areas include killing the vegetation and changing the microtopography of the area; this has implications for the hydrology and vegetation, which are very sensitive to slight (inches) changes in topography.

4.5 Wildlife Resources

The region supports a variety of wetland dependent wildlife, including several federally and State-listed endangered and threatened wildlife species. A reduction of the wetland function and value of coastal and inland habitats within and adjacent to the C-111 Spreader Canal Project study area associated with the spread of development and land conversion, is likely to result in an overall loss of fish and wildlife resources within the project area in the future. Disruption of the natural hydrology has resulted in aquatic vegetation community changes and a resultant disruption of aquatic productivity and function that has had repercussions throughout the food chain including wading birds, raptors, larger predatory fishes, reptiles (crocodiles and alligators), and mammals. These effects would likely continue given demands associated with environmental changes for the next 50 years.

Productivity of native fish species (Figure 4), many important as prey species for wading birds, has been and will continue to be depressed due to water management practices (Ogden 1994; Loftus and Eklund 1994) and other factors previously discussed.

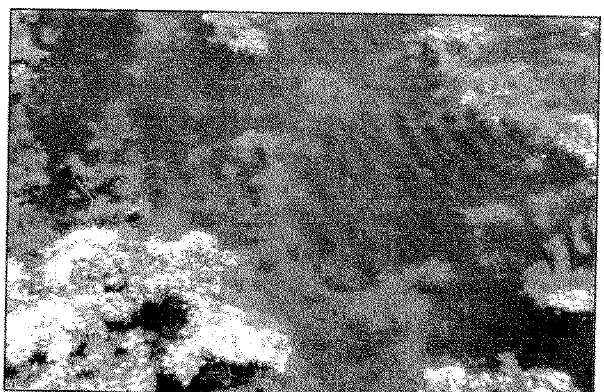

Figure 4: Typical marl prairie habitat with associated small native fish species

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Introduction and spread of a wide range of exotic fish species has increasingly been problematic in the project study area (Figure 5). The causative factors for this exotic fish problem include illegal introductions, unnatural habitat due to construction of canals and impoundments, and the establishment of vectors for travel and refugia (linear canals and deeper water) unlike the natural Everglades environment. Evaluation of the effects on occurrence and productivity of native fish species is controversial at best, but some studies report that the effect is negative and will be exacerbated in the next 50 years (Turner et al. 1999; Trexler et al. 2000; Kline et al. 2003).

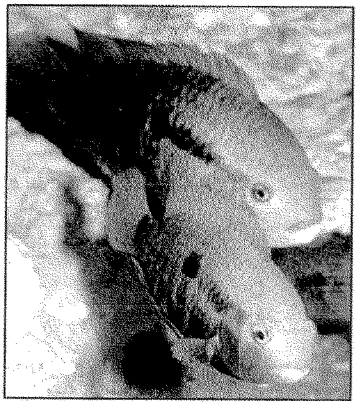

Figure 5: Black acara

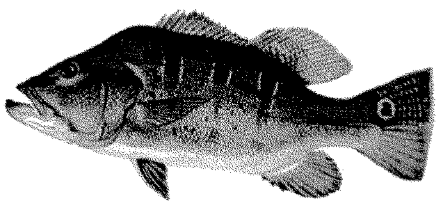

Figure 6: Butterfly peacock

Maintenance of the popular sport fishery for non-native species such as the butterfly peacock (*Cichla ocellaris*) (Figure 6), and native largemouth bass (*Micropterus salmoides*) should remain largely unaffected in the future without the C-111 Spreader Canal Project.

4.5.1 Population Diversity

The spread of invasive exotic plant species such as Brazilian pepper, Australian pine, melaleuca, old world climbing fern, and shoebutton ardisia has resulted in the conversion of large acreages with a variety of native vegetative species to less diverse and in some cases mono-specific vegetative cover with reduced value as wildlife cover (Figure 7).

Figure 7: Example of habitat diversity loss in dense stand of melaleuca

An increased coverage of exotic vegetation associated with continued land disturbance is anticipated in a 50-year future-without project scenario. Likewise, marsh areas subjected to higher levels of phosphorus are prone to support the invasion and spread of cattail which further reduces habitat quality and marsh and aquatic wildlife species diversity. Urbanization and associated habitat changes and anthropogenic effects (pets, exotic species releases, wildlife mortality, etc.) will negatively affect vegetative and wildlife native species number and occurrence. These effects are expected to worsen in the next 50 years without the benefits accrued from the project.

4.5.2 Threatened and Endangered Species

Without the environmental benefits of the C-111 Spreader Canal Project, urbanization, water demands, direct loss of habitat, and other demands for land, as well as degradation of existing habitat function will likely result in a continued decline in populations of threatened, endangered, and state listed species during the next 50 years. A discussion of species of particular concern follows.

4.5.2.1 American Crocodile

Habitat loss due to development required to support a rapidly growing human population along coastal areas has been and continues to be the primary factor endangering the American crocodile (*Crocodylus acutus*) (Figure 8) in Florida. Field and laboratory data suggests that low nest success combined with high hatchling mortality were the primary factors affecting survival. Florida and Biscayne bays are undergoing a number of changes affecting the present and future health of these ecosystems. Crocodile survival is linked to regional hydrological conditions, particularly rainfall, water levels, and salinity. Alternatives for improving water delivery into south Florida estuaries may change salinities, water levels, and availability of nesting habitat in the receiving bodies of water. The rate of mortality of hatchling crocodiles is correlated with the distance that hatchlings have to disperse to find nursery habitat. Nursery habitat is characterized by areas that are protected from wind and wave action, have a salinity range from 0 to 20 parts per thousand, abundant food, and shelter from predators (Mazzotti et al. 2002). Crocodile growth rates are associated with the timing and intensity of salinity levels. American crocodiles thrive in healthy estuarine environments, and are particularly dependent on natural freshwater deliveries. Crocodiles will benefit from restoration of freshwater flow into their estuarine habitat, and harmed by diversion or restriction of flow. Quantity, timing, and distribution of flow are important. Freshwater flows directed through fringe mangrove swamps (rather than diverted to the ocean through canals as is presently occurring and will happen in the future without project condition) will be beneficial to crocodiles.

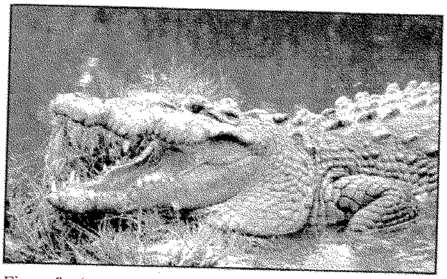

Figure 8: American crocodile

Collisions with automobiles continue to be the major documented cause of mortality of crocodiles in Florida, with most of these occurring on U.S. Highway 1 or Card Sound Road. Management of large crocodiles needs to focus on expanding protected habitat and reducing road mortality of large individuals. Combined, many of the natural and anthropogenic factors described above have resulted in adverse effects to the American crocodile. Compared to historical estimates of 1,000 to 2,000 animals, populations had declined to a low that apparently occurred sometime during the 1960s or 1970s estimated to be between 100 and 400 non-hatchlings (Ogden 1978). The American crocodile population in south Florida has increased substantially over the last 25 years and is estimated at around 500 to 1,000 individuals including hatchlings. Habitat protection has accounted for much of this increase but would be unlikely to produce a much greater population increase given potential future human encroachment, development, and land use changes.

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4.5.2.2 American Alligator

The American alligator (*Alligator mississippiensis*) (Figure 9) is a keystone species of the south Florida ecosystem. The American alligator's role as a top predator and its effect on the structuring of plant communities and associated aquatic animals (Mazzotti and Brandt 1994)

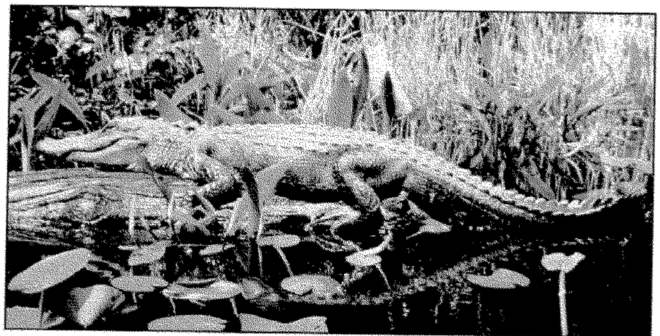

Figure 9: American alligator

make it an ideal indicator of ecosystem health. Population growth and survival depends directly on the hydrologic functioning of south Florida watersheds. Each of these watersheds has experienced, and continues to experience, substantial degradation. Current water management practices have and will continue to result in a high and unpredictable rate of nest flooding. Historically, maximum summer water levels were positively correlated with water levels during alligator nest construction. This natural predictability has been lost. Historically, alligators were abundant in prairie habitats of the eastern floodplain and along the edge habitats of deeper sloughs. Predrainage occupancy of the deep water, central sloughs was relatively low. Given the shortened hydroperiod and lowered water tables in the Everglades caused by drainage (Fennema et al. 1994; Van Lent et al. 1993; VanZee 1999), the alligator has mostly abandoned the southern marl prairies, and today and for the foreseeable future with out project scenario, the distribution of the alligator in the southern Everglades is shifted to sloughs, canals, and some deeper areas (Craighead 1968; Mazzotti and Brandt 1994). Implementation of the C-111 Spreader Canal Project should reverse these trends.

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4.5.2.3 Eastern Indigo Snake

In south Florida, the eastern indigo snake (*Drymarchon corais couperi*) (Figure 10) is widely distributed but is not commonly found in great numbers in the wetland complexes of the Everglades. They can however be found in pine rocklands, tropical hardwood hammocks, tree islands, coastal prairies, mangroves, freshwater marshes, abandoned agricultural land and human altered habitat such as levee banks. Because of its relatively large home range, this snake is especially vulnerable to habitat loss, degradation, and fragmentation caused by residential and commercial construction and agriculture, and (Lawler 1977; Moler 1985). Habitat destruction and alteration for the present and foreseeable future will be most substantial along the coasts, in the Florida Keys, and along the high ridges of south-central Florida, where human population growth will continue to accelerate. Agricultural interests continue to destroy large expanses of suitable habitat throughout the project area. Even with continued habitat destruction and alterations, this species will probably persist in most areas if large, unfragmented pieces of suitable habitat persist (Service 1999). However, continued habitat fragmentation will result in isolated small groups of indigo snakes that cannot ensure the continuation of viable populations.

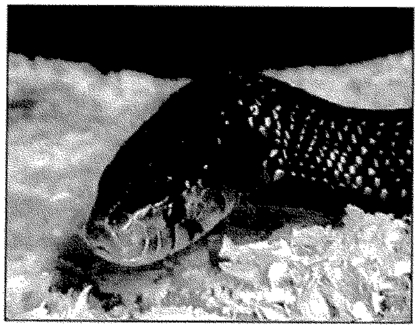

Figure 10: Eastern indigo snake

4.5.2.4 Florida Panther

Florida panther (*Puma concolor coryi*) (Figure 11) habitat in the C-111 Spreader Canal Project study area includes habitat designated as primary/dispersal zone in the Landscape Conservation Strategy for the Florida Panther in south Florida. This habitat (primary/dispersal zone) is considered to be the most important area needed to support a self-sustaining panther population.

The Florida panther's existence is threatened by extinction processes. Population viability analysis projections indicate that under existing demographic and genetic conditions the panther could be extinct in 24 to 63 years (Seal et al. 1992). Environmental factors affecting the panther include: habitat loss and fragmentation, contaminants, prey availability, human-related disturbance and mortality, disease, and genetic erosion (Dunbar 1993). Present and probable future population growth and agricultural expansion in south Florida are compromising the ability of natural habitats to support a self-sustaining panther population. The C-111 Spreader Canal Project study area has not been documented in recent years to be heavily used by Florida panthers compared to the current core panther population in Everglades National Park and Big

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Cypress National Preserve. A future without project scenario for the Florida panther for the next 50 years, however, would not contribute to Florida panther recovery and the Landscape Conservation Strategy for the Florida panther in south Florida.

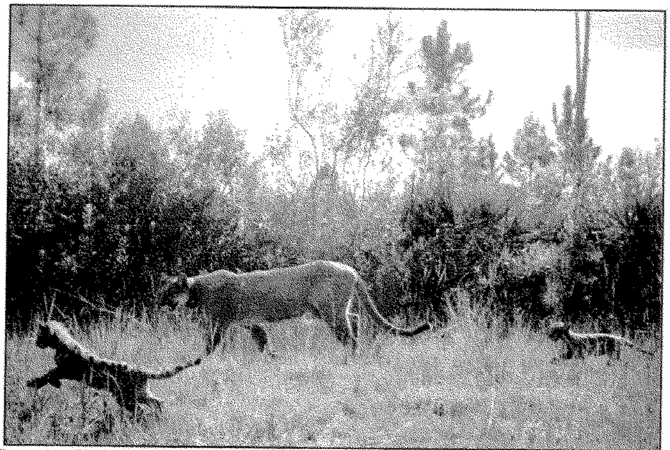

Figure 11: Florida panther and cubs

4.5.2.5 West Indian Manatee

The major threats faced by the West Indian manatee (*Trichechus manatus*) (Figure 12) today and continuing into the future are many fold. Collisions with watercraft in recent years account for an average of 25 percent of known manatee deaths in Florida annually. Deaths attributed to water control structures and navigational locks represent 4 percent of known deaths.

The future of the current system of warm-water refuges for manatees is uncertain as deregulation of the power industry in Florida occurs and if minimum flows and levels are not established and maintained for the natural springs on which many manatees depend. There are also threats to habitat caused by coastal development throughout much of the manatee's Florida range. Florida's human population is growing significantly in conjunction with intensive coastal development with the greater part occurring in the 35 coastal counties. An increase in boating traffic associated with this population increase will potentially increase collisions with watercraft and associated manatee deaths. Natural wintering sites in south Florida have been and continue to be altered by activities such as rip-rapping and bulkheading shorelines, diverting or capping sources of warmer water, and elimination of foraging and resting areas. Demands for water for

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residential, industrial, and agricultural purposes from the aquifer have and will continue to diminish spring flows as will paving and water diversion projects in spring recharge areas. Nutrient loading from residential and agricultural sources is promoting the growth of algae and clouded water columns, reducing available forage in seagrass beds and refuges. There are also threats from natural events such as red tide and cold events. Survival of manatees will depend ultimately on maintaining the integrity of ecosystems and habitat sufficient to support a viable manatee population. The majority of manatee observations in the C-111 Spreader Canal Project study area have been in the C-111 canal below S-197, the Card Sound Road borrow canal south of the L-31E confluence, the Turkey Point Power Plant outfall canals south of the cooling pond, and along various keys in Florida Bay and the sounds. A future without project scenario for this project will do little to change the accelerating threats faced by the manatee.

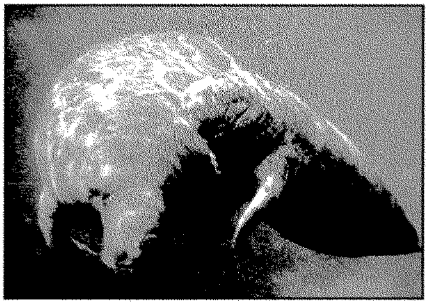

Figure 12: West Indian manatee

4.5.2.6 Wood Stork

The prognosis of the U.S. wood stork (*Mycteria americana*) (Figure 13) population over the next 50 years is partially dependent on the success of CERP. It is believed that by restoring the quantity, quality, timing, and distribution of flows in the remaining Everglades wetlands that the prey base so critical to wood storks during the breeding season will be recovered in both the estuarine and freshwater systems. No critical habitat or documented nesting colonies exists in the C-111 Spreader Canal Project study area. The C-111 Spreader Canal Project area is suitable foraging habitat for wood storks and within the maximum 18.6-mile core foraging area of documented nesting colonies outside the project area. Almost all of the freshwater marsh and estuarine areas in the project study area can be considered suitable wood stork foraging habitat. Although we have lost approximately 35 percent of the original foraging grounds

Figure 13: Wood stork

and the quality of much of the remaining wetlands has become and will continue to be degraded as foraging habitats, if efforts to restore the south Florida ecosystem are successful, a system with heterogeneity and inherent variability will be recreated, which should provide the prey base necessary to restore the wood stork in south Florida. A future without project scenario for this project will not include those benefits to be accrued by the C-111 Spreader Canal Project portion of CERP.

4.5.2.7 Cape Sable Seaside Sparrow

The Cape Sable seaside sparrow (CSSS) (*Amodramus maritimus mirabilis*) (Figure 14) occupies short-hydroperiod mixed-marl prairies characterized by muhlenbergia grass with relatively short hydroperiods. The CSSS avoids sawgrass dominated areas with longer hydroperiods as these areas do not usually allow a suitable dry period for nesting. Conversely, the CSSS avoids areas where woody vegetation has encroached due to overdrainage. In the Taylor Slough area increased water levels due to pumping have precipitated vegetation community dominance shifts to the detriment of CSSS breeding habitat. Sparrows have a high level of site fidelity, meaning that they will occupy former optimal habitat areas long after conditions become unacceptable for reproduction.


Figure 13: Wood stork

If current water management that results in higher unnatural water levels continues, the CSSS faces an unnaturally high risk of extinction (Service 1999). The role that fire plays in CSSS ecology is not well understood. While fire is a natural part of the everglades ecology, and can serve to reduce the density of sawgrass and woody vegetation, it can prevent vegetation from becoming too thick to allow CSSS nesting and preclude the sparrows from effectively foraging for food, as well as provide adequate cover from predators. The CSSS populations in the western portion of the C-111 Spreader Canal Project study area (specifically subpopulations C and D) have already declined to near record lows and will continue to decline unless the hydrologic regimes are changed to reduce the frequency of fire in subpopulation C and reduce the frequency of flooding in subpopulation D.

4.5.2.8 Everglade Snail Kite

No designated critical habitat for the Everglade snail kite (*Rostrhamus sociabilis plumbeus*) (Figure 15), is found within the C-111 Spreader Canal Project study area. Wetlands in the Everglades region supporting the snail kite include Taylor Slough and the C-111 basin west of U.S. Highway 1. The project is expected in general depending on the alternative selected and final water management regime, to have an overall benefit to snail kites by providing improved seasonal foraging habitat and recovery of native marsh vegetation and prey species. Recent population data collected appears to indicate that the snail kite population in Florida is declining.

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The reasons for the decline are unclear but anthropogenic activities, hydrologic management, aquatic weed control, natural climatic fluctuations, and possibly West Nile virus all could conceivably have had an effect. The principal threat to the snail kite in south Florida is the loss or degradation of wetlands for agricultural and urban development. Degradation of water quality, particularly runoff of phosphorus from agricultural and urban sources is another threat to the snail kite. The Everglades was historically an oligotrophic system, but major portions have become eutrophic. Nutrient enrichment leads to growth of dense stands of herbaceous emergent vegetation, floating vegetation (primarily water hyacinth and water lettuce) and woody vegetation, which inhibits the ability of snail kites to find food. Without the environmental benefits of the C-111 Spreader Canal Project, urbanization, water demands, direct loss of habitat, and other demands for land, as well as degradation of existing habitat function will likely result in a continued decline in snail kites during the next 50 years.

Figure 14: Everglade snail kite

4.5.2.9 Bald Eagle

No recent bald eagle (*Haliaeetus leucocephalus*) (Figure 16) nesting activity has been recorded in the C-111 Spreader Canal Project study area. Suitable foraging habitat for bald eagles does exist throughout the project area. Preferred habitat for bald eagles consists of large, open-water bodies for foraging and suitable perch and nesting sites nearby. Creation of storage reservoirs, storm water treatment areas, and large canals could provide this open water habitat. New electrical lines associated with urbanization and any pumps installed with water control structures could present an electrocution hazard for eagles. In Florida overall, bald eagle nesting has increased substantially since the early 1970's. In Everglades National Park, nesting has

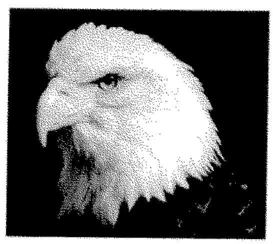

Figure 15: Bald eagle

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remained relatively constant during the same period. A future without project scenario in the C-111 Spreader Canal Project study area would offer no habitat enhancements to expand eagle populations in the project area and could increase electrical line hazard due to increased urbanization and associated infrastructure.

4.5.3 Wading Birds

Although there are fluctuations of nesting success for wading birds that are driven by climatic as well as water control related issues, in general, nest numbers and success of wading birds have decreased dramatically across south Florida over the past 100 years. These results are especially evident in data collected for wood storks and white ibis (*Eudocimus albus*) (Figure 17). Although data is less complete and suggests regional and short time period increases for species such as the great egret (*Casmerodius albus*), great blue heron (*Ardea herodias*), cattle egret (*Bubulcus ibis*), and little blue heron (*Egretta caerulea*), evidence suggests that the degree to which these species populations have increased system-wide and over the longer periods of time is less convincing.

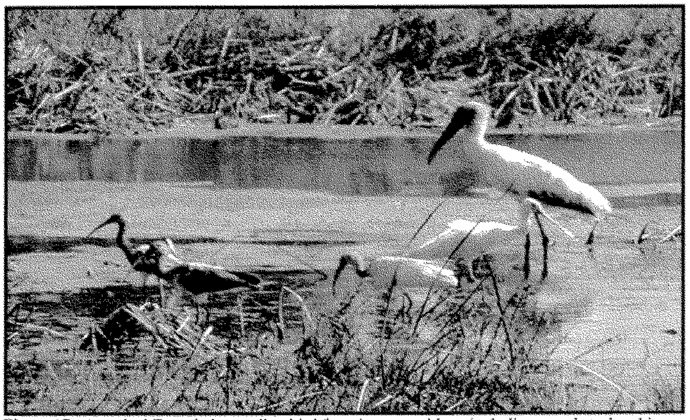

Figure 17: A typical Everglades wading bird foraging assemblage including wood stork, white ibis, and roseate spoonbill

A long term scenario that does not include habitat restoration components of CERP currently being evaluated would undoubtedly result in a continued overall decline in wading bird species due to continued encroachment into habitat and anthropogenic influences on water supply.

Historically, the area northeast of Florida Bay in the southwest portion of the C-111 Spreader Canal Project area was the most productive sub-region of the bay for roseate spoonbill (*Ajaja ajaja*) (Lorenz et al. 2002). This area has more recently been heavily impacted by water control structures and management measures that supply water to these foraging grounds (Lorenz 2000). Nesting effort success in other active sub-regions compared to the northeastern sub-region gives increased credibility to the conclusion that the observed decline is anthropogenic in nature. Other sub-regions in roseate spoonbill nesting habitat are buffered by distance from water management practices. Unless major changes are implemented to water management practices that affect roseate spoonbill habitat and Florida Bay in general, these areas will continue to decline in ecologic health with resultant further detrimental effects on roseate spoonbill.

The extent of wetlands needs to be maximized by restoring degraded marshes in the project study area wherever possible. The natural connectivity in the system should be increased by reducing compartmentalization and the critical features of natural hydrology should be replicated. Hydroperiod restoration in presently over-drained marl wetland areas will increase the frequency of years when prolonged wet season and natural drying patterns produce and concentrate fishes to attract larger seasonal aggregations of foraging birds. The interspersion of slough and wet prairie habitats into areas of dense grass, development of tree islands, and protection of areas that are currently most productive needs to be accomplished in the future. Where possible, water management needs to be conducted to lengthen hydroperiods without greatly deepening water levels. Few of these project-related environmental benefits will be realized in a future without project scenario over the next 50 years.

Closing Comments

The C-111 Spreader Canal Project has the potential to have wide-ranging effects on fish and wildlife resources. We appreciate this opportunity to provide planning guidance to the Corps on the C-111 Spreader Canal Project and look forward to continuing to provide technical support to the Corps during all phases of this important project. If you have any questions regarding this letter, please feel free to contact Richard Fike at 772-562-3909, extension 262.

Sincerely yours,

James J. Slack
Field Supervisor
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DEP, West Palm Beach, Florida
DERM, Miami-Dade County, Miami, Florida (Dr. Susan Markley)
District, West Palm Beach, Florida (John Shaffer/Dewey Worth)
ENP/NPS, Homestead, Florida (John Klochak/Mike Zimmerman)
FWC, Vero Beach, Florida (Dr. Joseph Walsh)
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20[th] Street
Vero Beach, Florida 32960

November 22, 2005

Stuart Applebaum
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Attention: Brad Tarr

Dear Mr. Applebaum:

The Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the C-111 Spreader Canal Project in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (FWCA) (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This letter does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA.

Introduction

Project planning for the Comprehensive Everglades Restoration Plan, C-111 Spreader Canal Project has progressed to the point where an array of alternatives has been formulated and will be evaluated. Most of these alternatives include a component incorporating a stormwater treatment area (STA) to provide for improvement in water quality from a variety of nutrients and pollutants and/or a reservoir for storage of water during peak periods of runoff to be released when the flows are needed or to prevent excess discharge of stormwater to the estuarine and marine environment. The Service has conducted an in depth literature review of STA and reservoir construction and management, evaluated existing STAs and reservoirs in southern Florida, and formulated recommendations for optimal siting, configuration, and operation (Service 2004). Our goal is to maximize the value of these components for fish and wildlife as well as water quality enhancement, while maintaining the primary function for which the facility was intended. These facilities provide a unique opportunity to enhance habitat for a multitude of fish and wildlife when properly constructed and operated. The Service advises consideration for implementation, where applicable, of the following recommendations during the planning, construction, and operations phases of any C-111 Spreader Canal Project STA or reservoir facility.

TAKE PRIDE IN AMERICA

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General Recommendations

Contaminants

Evaluate and Remediate Contaminants. Evaluate potential STA sites prior to acquisition in accordance with Service (Appendix A), and South Florida Water Management District (SFWMD) (Appendix B), guidance. Site remediation, if necessary must occur prior to construction in areas where contaminant concentrations could compromise fish and wildlife as well as public health. Adherence to this process will eliminate or reduce contaminant remobilization, exposure risks to fish and wildlife, long-term treatment and remediation costs, and optimize STA and reservoir function by eliminating potential contaminant remobilization.

Clean Construction Materials. Evaluate construction materials for contaminants prior to use for levees, berms, islands, etc. Do not use materials from contaminated areas. Assuring the use of clean construction materials prevents mobilization of contaminants and reduces exposure risk to fish and wildlife and the public.

Contaminant Monitoring. Implement a post-construction monitoring and contingency plan for mercury, pesticides, and other toxicants as described in the draft Contaminants of Concern, Comprehensive Everglades Restoration Plan (CERP), Guidance Memorandum (Appendix B). Contaminant monitoring and contingency plan implementation will alert mangers to potential exposure risks to fish and wildlife and prevent contaminant remobilization.

Design and Location

Facilities Location. Locate potential STA and reservoir facilities in the project area where water volumes will optimize water treatment (by placing them adjacent to reservoirs or canals), and minimize "dry-outs" (water below bed surface). Avoid ecologically sensitive areas such as Florida panther primary zone and Cape Sable seaside sparrow critical habitat (Figure 1), and higher quality wetland habitat. Locate facilities to maximize water supply, storage, treatment, and management to benefit fish and wildlife resources and habitats. Locate facilities to reduce direct (footprint) and indirect (*e.g.*, hydrological modifications, fragmentation) impacts to fish and wildlife resources and habitats. When practicable, locate facilities to minimize potential remobilization of pollutants including contaminants and nutrients.

Heterogeneous Topography. Preserve and maximize heterogeneous topography, such as berms, ditches, farms roads and emergent vegetated rows (Figure 2). Preserve or create features that reduce the potential for hydrologic short-circuiting. Preserving heterogeneous topography supports habitat diversity, enhances biochemical processes over a wide range of water elevations, and provides refugia for aquatic/forage species during critical periods (*e.g.*, winter or drawdown), (Figure 3). Heterogeneous topography has the potential to increase hydraulic residence time and treatment efficiency, reduce design, construction, and maintenance costs, and reduce the potential for hydrologic short-circuiting.

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Shallow Pools/Interior Perimeter Canal. Preserve distribution and collection canals, and/or an interior perimeter canal or create shallow pools (some at least 3 feet deep), to provide aquatic plant, and fish habitat, and refugia for other aquatic resources during critical periods (*e.g.*, low water events). The size and extent of these features should be proportional to the facility size. Shallow pools can improve hydrologic mixing, increase hydraulic residence time, and reduce resuspension of sediment-bound pollutants.

Sloping Vegetated Zones. Include gradually sloping/stepped vegetated littoral zones along shorelines in STAs, reservoirs, and seepage canals (Figure 4). Sloping/stepped vegetated zones provide habitat for plant diversity, fish spawning, and wading bird foraging during water level manipulation. Sloping/stepped vegetated zones can further function to maintain bank stability, resist erosion, and contribute to turbidity reduction.

Provide organic soil over hard substrates where soil is lacking, and manage for native vegetation. Organic soil provides for aquatic vegetation which promotes viable aquatic ecosystems.

Irregular Shorelines. Preserve irregular shoreline features such as peninsulas and submerged bars. Irregular shorelines provide visual cover, increase habitat edge, and support biologically rich and diverse zones (Figure 5). Irregular shorelines may provide for design and construction cost savings (example: maintenance access for existing utilities), (Figure 6).

Low-profile Vegetated Areas. Preserve low-profile vegetated areas in appropriate locations upon which native plants are established and maintained (Figure 7). Low-profile vegetated areas increase habitat diversity and support fish and wildlife activities such as loafing, feeding, and sheltering (Figure 8). Low-profile vegetated areas may prevent hydrologic short-circuiting, enhance retention time, and improve hydrologic mixing.

Multi-cell Flow ways. Design cell sequence to minimize wildlife use in downstream portions of polishing cells. Design STAs with multi-cell flow ways to increase maintenance flexibility, treatment efficiency, and reduce short-circuiting (Figure 9). In addition, multi-cell flow ways can function to increase habitat diversity, structure, and composition (*e.g.*, more edge, vertical structure).

Vegetated Buffers. Create or maintain vegetated buffers (*e.g.*, 100 to 500 meters wide) adjacent to STA and reservoir levees, and seepage collection canals. Vegetated buffers adjacent to STA/reservoir levees and seepage collection canals provide habitat for amphibians, reptiles, neotropical migrant birds, and other wildlife (Figure 10). Vegetated buffers create natural aesthetic and safety barriers between constructed facilities and developed areas, provide wildlife travel corridors, and reduce seepage impacts to neighboring property. Manage buffers to control invasive exotic vegetation.

Wading Bird Foraging Conditions. When flood control and water supply requirements are met, maintain water depths in STAs/reservoir between 6 and 14 inches (15 to 35 cm) for a minimum 90-day period from January through May. This may be partially accomplished by heterogeneous topography and/or water management. Maintenance of shallow water conditions provides wading bird foraging opportunities during the nesting season (January through May). Maintaining wetted cells (within the constraints of weather conditions and competing water demands enhances phosphate removal, reduces pollutant remobilization, and reduces mercury methylation.

Biological Diversity

Long-hydroperiod Marsh. When water supply needs are met, maintain long-hydroperiod marsh cells that are inundated 3- 5 years between dry-outs, to the maximum extent practicable. Long-hydroperiod marsh ecosystems support natural communities, resulting in a stable food web. Long-hydroperiod marsh ecosystems improve water treatment and can minimize maintenance.

Delayed Cell dry-outs. In reservoir-assisted STAs, delay scheduled dry-outs until after May 15, or as late as possible, by holding water in reservoirs. Delayed dry-outs in cells containing water during late dry season (Jan thru May) increases survival of offspring (*e.g.* apple snails and other aquatic organisms) to the following wet season. Delayed dry-outs can reduce maintenance costs associated with rehydration.

Recession Rates and Reversals. Manage reservoir/STA water levels to gradually recede, and minimize rapid reversals during the dry season (Oct through Apr), when possible. Slowing recession rates and reversals will concentrate wading bird prey in a manner similar to natural water recessions, protect low-lying nests from flooding, increase retention time, and increase water treatment efficiency. Optimally managing recession rates can be complicated by weather and competing water demands.

Water Quality

Passive Flow Technology. Use best available, passive flow technology (baffles, distribution and collection canals, etc.), to evenly distribute inflows and aerate water at inflow and outflow points. Passive flow technologies that distribute and aerate inflows/outflows can benefit wildlife by increasing dissolved oxygen (DO) concentrations and reducing pockets of stagnation (Figure 12). Passive flow technologies that distribute and aerate inflows/outflows can also increase water treatment efficacy by reducing short-circuiting, distributing water evenly, improving hydrologic mixing, and increasing DO levels.

Avoid Reservoir/STA Dry-outs. Avoid dry-outs to prevent mercury methylation and reduce pollutant release during rehydration. Avoiding dry-outs benefits wildlife by sustaining aquatic communities in STAs and reservoirs, protecting aquatic resources from contaminant exposure, and protecting and enhancing downstream ecosystems. Avoiding dry-outs increases treatment efficiency, impedes mercury methylation, and prevents release of sequestered nutrients.

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Water Retention after Dry-outs. At facility start-up and after dry-outs, raise water levels in the reservoir and/or STA quickly to a depth greater than 35 cm. Retain water levels until water quality is acceptable for discharge to the receiving water body pursuant to applicable federal and state regulations and legally binding documents. Water retention after dry-outs will reduce the release of methylmercury and high nutrient pulses. Methylmercury is toxic to wildlife. High nutrient pulses can negatively impact downstream plant and animal communities. Water retention after dry-outs improves water quality treatment efficiency.

Chemical Treatment. Avoid applying chemical treatments in STAs and reservoirs to achieve phosphorus reduction targets. Chemical treatments for phosphorus reduction expose wildlife and their habitat to unknown risks. Chemical treatments for phosphorus incur continuous operation costs which are avoided with natural treatment methods.

Iterative Process

Hydrologic Operating Plans. Develop and implement hydrologic operating plans to maintain water levels for desired plant communities. Hydrologic operating plans sustain vegetation for fish and wildlife survival and reproduction by planning for beneficial water management. Hydrologic operating plans enhance water treatment and storage functions. These plans should include iterative monitoring and adaptive assessment.

Coordinate STA operating issues with the SFWMD's STA Communication Team. Coordinated monitoring and communication between state and federal agencies can improve management for fish and wildlife benefits. Coordinated monitoring and communication between state and federal agencies can improve system management and decrease time between operational adjustments.

Monitoring Plan. Design and implement a monitoring plan for water and sediment quality to trigger the adaptive management process. Include standards for operation contained in the project Hydrologic Operating Plan. Monitoring provides knowledge of fish and wildlife habitat, water and sediment quality, response to STA and reservoir operations, and early detection and resolution of potential problematic wildlife issues. Monitoring assesses water treatment and storage efficiency. Environmental permits issued to the SFWMD include compliance criteria which necessitate routine monitoring, reporting, and adaptive management responses.

Adaptive Assessment and Management. Develop and implement a facility monitoring plan with adaptive management. Include annual evaluation of compliance with targets for adaptive assessment. Adaptive assessment and management improves facility operations that benefit fish and wildlife. Adaptive assessment and management improves facility operation for water treatment and storage functions. Environmental permits issued to SFWMD include compliance criteria which necessitate routine monitoring, reporting, and adaptive management responses.

Avian Protection Plan. Develop and implement an avian protection plan based, in part, on lessons learned from the management of existing projects. An avian protection plan supports avian diversity and listed species recovery, can assist in maintaining and enhancing avian

Stuart Applebaum Page 6

populations and improve operational flexibility by defining operation and management options concerning wildlife issues.

Public Use

Recreational Use. Provide compatible public recreational opportunities as identified in the CERP Master Recreation Plan. Compatible recreational use promotes public awareness of fish and wildlife conservation and provides multi-purpose facilities for public benefit. Recreational uses generate public support for STA and reservoir projects. Recreational uses must be compatible and not conflict with the primary function of the STA or reservoir.

Project Specific Recommendations

Planning for the C-111 Spreader Canal Project has produced a current array of alternatives that comprise potential STA/reservoir(s) at one of 3 locations; 1) the triangle area east and south of S-177 between C-111 and C-111E (Yellow Book Plan), 2) the Frog Pond area west of C-111 between S-176 and S-177, 3) at the southern extent of Ludlum Slough (C-111E/S178) above the northern spreader canal alignment (Figure 14). Recommendations specific to these locations include:

Retain or enhance the residual tree island/hammock habitat where it exists in northern extent of the proposed reservoir/STA at the Frog Pond location (Figure 14).

Preserve or enhance flooded native species woody vegetation that exists in all potential STA locations if compatible with management of the facility and the species life history requirements.

Utilize lower lying areas in the central portion and southern edge of the proposed reservoir/STA at the Frog Pond location and retain/degrade existing ditches as topographic features where they will not impair the function of the facility.

If proposed locations for STA/reservoir currently support invasive species such as Brazilian pepper, Australian pine, shoebutton ardesia, melaleuca, torpedo grass, etc., eradicate existing stands prior to construction of the feature. This will minimize the potential for reinvasion following construction. It may be necessary however to provide periodic post project control to maintain the native composition of the vegetative community and prevent reestablishment of invasives.

Consider constructing screening or other preventative structures to stop movement into and establishment of undesirable aquatic non-native fish species in the reservoir/STA that could become a refugium for their further spread. If management for non-native species is determined to be compatible with the operation of the facility (i.e. recreational fishing) these species can be introduced and appropriate measures taken to prevent their escape.

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Conclusion

There is an opportunity to include a number of fish and wildlife enhancement features in the design and operation of STAs and reservoirs. Features that mimic natural ecological processes, functions, and habitat diversity would promote sustainable wetland communities, and may be compatible with primary design functions. The Service does not suggest all recommendations presented are applicable or practicable for all project sites. However, during plan formulation, these recommendations should be considered in STA and reservoir design and operation when and if they are compatible with the primary design functions of the project. It is important that all operational plans be developed with the participation and review of all appropriate state and federal agencies and disciplines, including biologists.

Closing Comments

The C-111 Spreader Canal Project has the potential to have wide-ranging effects on fish and wildlife resources. We appreciate this opportunity to provide planning guidance to the Corps on the C-111 Spreader Canal Project and look forward to continuing to provide technical support to the Corps during all phases of this important project. If you have any questions regarding this letter, please feel free to contact Richard Fike at 772-562-3909, extension 262.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

Enclosures

cc: w/enclosures
BNP/NPS, Homestead, Florida (Sarah Bellmund)
Corps, Jacksonville, Florida (Gregory Stormant, Jeffery Couch)
DEP, West Palm Beach, Florida
DERM, Miami-Dade County, Miami, Florida (Dr. Susan Markley, Gwen Burzycki)
District, West Palm Beach, Florida (John Shaffer/Dewey Worth)
ENP/NPS, Homestead, Florida (John Klochak, Mike Zimmerman)
FWC, Vero Beach, Florida (Dr. Joseph Walsh)
NOAA Fisheries, Miami, Florida (Dr. Joan Browder)
Service, Jacksonville, Florida (Miles Meyer)

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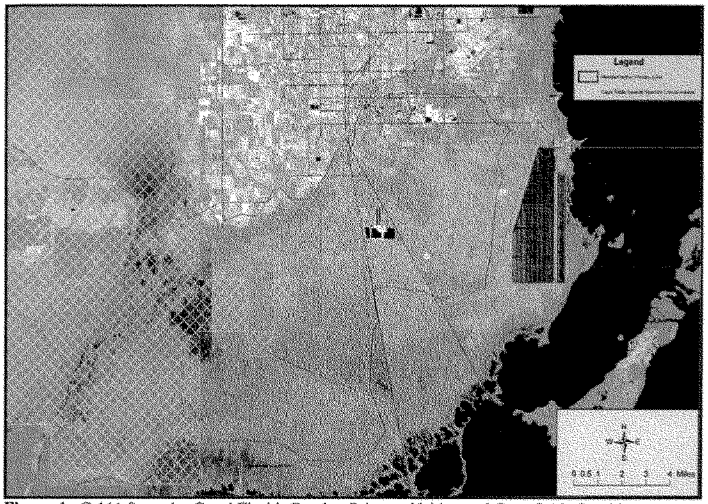

Figure 1. C-111 Spreader Canal Florida Panther Primary Habitat and Cape Sable Seaside Sparrow Critical Habitat.

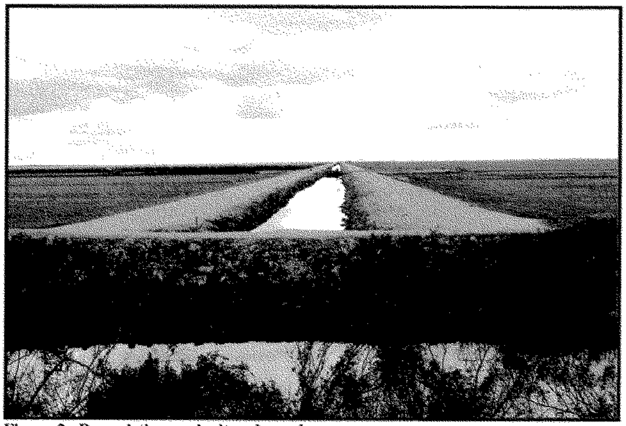

Figure 2. Pre-existing agricultural canal.

Figure 3. Heterogeneous topography preserved from pre-existing agricultural canal.

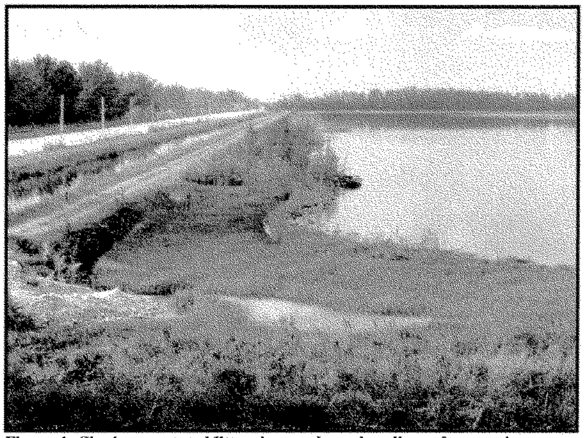

Figure 4. Sloping vegetated littoral zone along shorelines of reservoir.

Figure 5. Irregular shoreline that provides visual cover, increased habitat, and supports a variety of wildlife species.

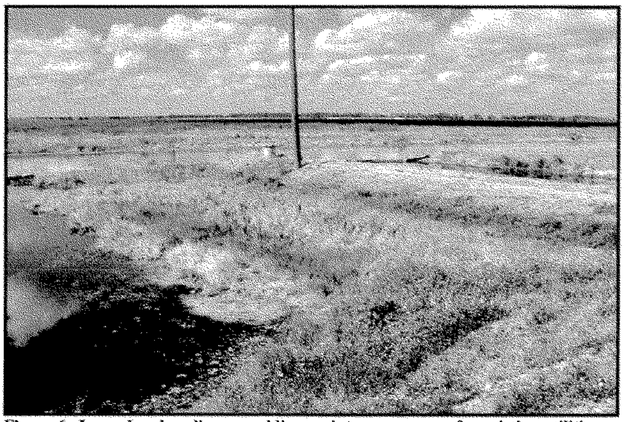

Figure 6. Irregular shorelines providing maintenance access for existing utilities.

Figure 7. Low profile vegetated island created from existing levee feature.

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Figure 8. Low profile vegetated island with native plants established and supporting wildlife activities such as loafing, feeding, and sheltering.

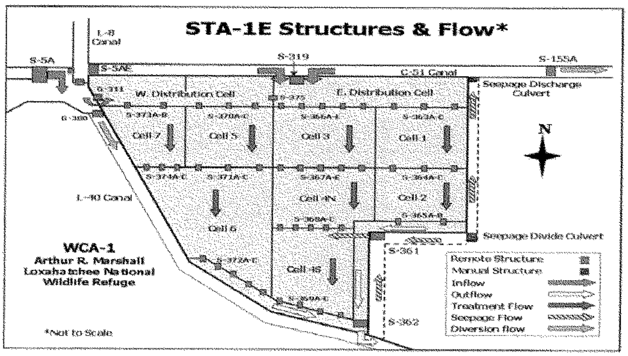

Figure 9. STA with multi-cell flow way.

Figure 10. Vegetated buffer along canal and separating access road.

Figure 11. Wading birds foraging.

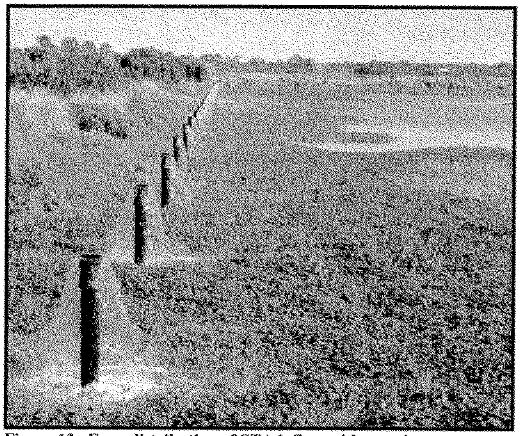

Figure 12. Even distribution of STA inflow with aeration.

Figure 13. Avoid dry-outs to prevent mercury methylation and pollutant release.

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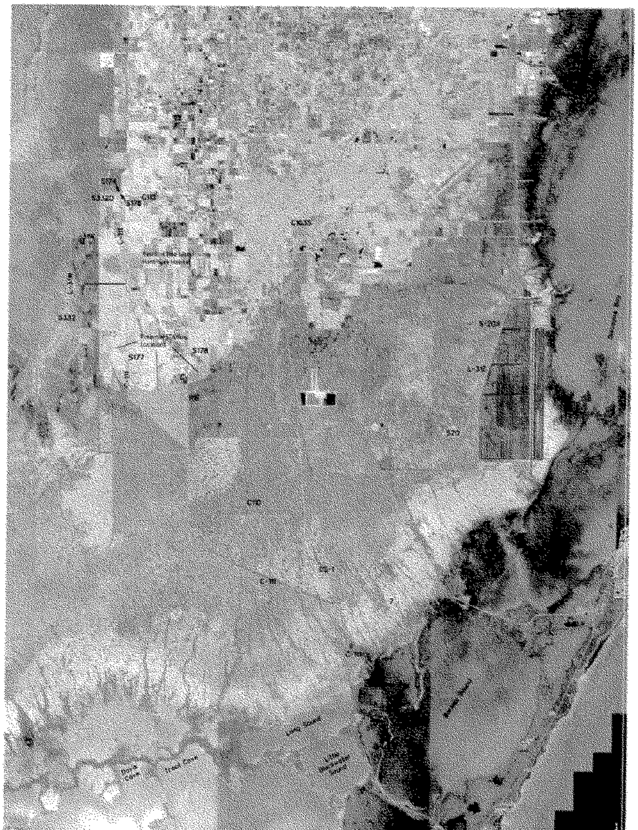

Figure 14. Potential STA/reservoir(s) and residual tree island/hammock habitat in northern extent of the proposed reservoir/STA at the Frog Pond location in C-111 Spreader Canal Project.

Appendix A

Ecological Risk Assessment Guidance

Draft

Ecological Risk Assessment Guidance for Wetland Restoration on Agricultural Lands in South Florida

U.S. Fish and Wildlife Service
South Florida Ecological Services Office
Vero Beach, Florida

November 2001
(Revised 8/30/04)

A-1

I. Contaminant Issues

Construction and implementation of the Comprehensive Everglades Restoration Plan (CERP) will require thousands of acres of publicly owned land (State and Federal) for the purpose of maintaining hydrologic buffer areas and the operation of regional water storage and conveyance systems. Lands determined to be feasible for incorporation into CERP projects in south Florida are limited and expensive, as increasing demands for commercial and residential development compete with the need for viable and functioning Everglades wetlands and adjacent scrub and forested uplands. A large portion of these lands are presently, or were at some time, in active agricultural production. Historical management practices, especially those associated with row crop farming, typically involved the frequent application of organochlorine (OC) pesticides for insect control. Most of these pesticides are no longer registered for use in the U.S. due to environmental concerns. However, from the 1940s to the mid 1980s, frequent applications of DDT, chlordane, toxaphene, and other OCs were common in agricultural areas of south Florida, leaving significant residual concentrations of these toxic substances and their degradation by-products bound to and sequestered in the top soil. Conversion of these soils from a dry and frequently disturbed aerobic environment to inundated (perennially or intermittent) relatively undisturbed anaerobic sediments, supporting native submergent and emergent vegetation and periphyton, will likely promote the release of these residual pesticides (along with other common contaminants such as mercury, selenium, and copper) into surface waters. More recent agricultural practices employ a different suite of pesticides, including organophosphates, carbamates, and a variety of herbicides and fungicides. Although generally not as persistent as OCs, many of these modern pesticides are highly toxic to wildlife.

Many of these lands proposed for acquisition will support functioning water reservoirs (storm water treatment areas, Aquifer Storage and Recovery detention reservoirs, and storage reservoirs) designed to impound a wide range of water capacities and depths over long periods of time. Additionally, many of these reservoirs will cover large expanses of several thousand acres, establishing local and regional aquatic ecosystems as well as providing foraging habitat for waterfowl and other aquatic wildlife. Without appropriate risk management and attention to design alternatives, the subsequent release of these pesticides and trace metals into CERP wetlands, reservoirs, and conveyances will provide exposure pathways to the regional fish and wildlife communities in south Florida.

Although the need for this guidance was prompted by the CERP land acquisition program, its use is encouraged for wetland restoration projects under other programs such as the Service's Partners for Fish and Wildlife Program, the Natural Resources Conservation Service's Wetland Reserve Program, or other water management districts in Florida.

II. Phase I Environmental Site Assessment

The Phase I Environmental Site Assessment (Phase I) is performed in accordance with the American Society of Testing and Materials (ASTM) Standard Practice E1527-00, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process."

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The purpose of the Phase I is to identify the presence or likely presence of any hazardous substance or petroleum product on the property. This includes conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substance or petroleum product into structures on the property or into the ground, groundwater, or surface water of the property. The Phase I should provide all available information on current and past land use, and consists of the following elements:

A. Site inspection

The site inspection usually consists of walking, driving and/or flying over the property to visually ascertain the presence of features or indicators of past land uses and possible environmental contaminants. A checklist of such indicators includes, but is not limited to, dumps, drums, construction debris, fills, unusual chemical odors, above ground and underground storage tanks, chemical storage buildings, asbestos evidence, "stressed" vegetation or bare ground, "sterile" water bodies, oiled roads, stained or discolored ground or stream banks, oil slicks, air strips, maintenance areas, pipelines, transformers or other electrical equipment, oil and gas drilling, and mining activities.

B. Historical considerations

The historical review should include interviews with owners, previous owners, and neighbors to obtain an accurate picture of past land uses, farming practices, pesticide usage, etc. Aerial photographs should be reviewed for evidence of row crops and other agricultural, commercial or industrial activities. At a minimum, the historical review should include reliable information on (1) farming practices (e.g., row crops, sugarcane, citrus, sod farm, ornamentals, grazing), (2) exact location of these practices on the property, and (3) farming chronology. For example, row cropping on a portion of the property during the period from the 1940s to the mid-1980s is strong suggestive evidence for the presence of OC pesticides at that location.

C. Review of environmental databases

An extensive review of environmental databases (Comprehensive Environmental Response, Compensation, and Liability Information System; Resource Conservation and Recovery Information System; National Priorities List; Emergency Response Notification System; state Above Ground and Underground Storage Tank records; Solid Waste Facility and Landfill Report; Florida State Hazardous Waste Site list; Facility Index System/Identification Initiative Program Summary Report; Formerly Used Defense Sites; and local mosquito control districts) should be conducted.

Information gleaned from the Phase I assessment is used to determine the necessity of a Phase II assessment.

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III. Phase II Environmental Site Assessment

Should information gleaned from the Phase I or other credible sources (i.e., previous investigations) indicate the presence of contamination or that the potential for contamination exists, a Phase II Environmental Site Assessment (Phase II) should be initiated. Coordination between the Service and the agency performing the assessment is important starting at this point and throughout the rest of the process. Coordination will be facilitated by providing the Service with a Phase II Scope of Work (SOW) or proposal for review. The proposal should describe in detail the sampling plan (number, media, and location of samples), sample collection methods, analytical parameters, quality control/quality assurance (QA/QC) plan, standards and/or ecological screening criteria to be used for comparison, contingency for expanded sampling, and screening level risk assessment procedures, if applicable. The environmental laboratory to perform chemical analyses should be EPA certified, maintain a rigorous QA/QC program, and achieve laboratory detection limits consistent with state and federally approved ecological screening values and water/soil quality standards. More detail on sampling procedures and analytical requirements is provided in the following section. The selection of a credible laboratory is one of the highest priorities in the site assessment process.

The purpose of the Phase II is to identify sources and locations of contamination, specify contaminants of potential concern (both human health and ecological), and provide recommendations for additional sampling, testing, or risk assessment; and corresponding corrective actions. The focus of the Phase II is generally on facilities and potential point sources on the property, which includes:

1. Mixing/loading areas
2. Storage sheds
3. Vehicle turn-arounds
4. Airstrips
5. Cattle dip tanks
6. Pumping stations
7. Burn areas

In addition, limited sampling may be conducted in other areas, such as canals and agricultural fields, in order to identify contaminants that have a more widespread distribution or to establish background levels of contaminants. Media sampled may include soils, sediments, groundwater and occasionally surface water. The most commonly encountered types of contaminants at agricultural sites include pesticides, petroleum hydrocarbons, and various metals.

Chemical concentrations in the various sampled media should be compared with the appropriate ecological screening values to determine if remediation and/or additional sampling is required. Ecological screening values to be used include the following:

1. Soils and sediments: Florida Department of Environmental Protection (FDEP) Sediment Quality Assessment Guidelines (SQAGs)

2. Surface water: Florida Surface Water Quality Standards, or USEPA Ambient Water Quality Criteria for protection of aquatic life

Ecological screening values are discussed in more detail in the next section.

Generally, any point sources identified can be remediated based on the results of the Phase II, with some additional delineation work. If remediation of the point source(s) removes all ecological concerns (i.e., all contaminant concentrations are reduced below screening values), no further assessment work is required on the site. However, if the results of the Phase I and/or Phase II indicate that widespread contamination at levels of ecological concern may be present, then more extensive sampling in the agricultural fields may be required (see next section).

IV. Agricultural Field Sampling and Screening

Generally, contaminant information obtained during a standard Phase I/Phase II Environmental Site Assessment (Phase I/II) is not detailed or comprehensive enough to be suitable for use in an ecological risk assessment (ERA). The methods described in this section are designed to provide detailed information on the distribution and concentrations of contaminants of concern (COCs) identified in the Phase I/II, for use in the food chain model to predict risks to Fish and Wildlife Service trust resources. A major purpose of this section is to determine whether concentrations of contaminants in the farmed areas are uniformly distributed in the fields, or are present as "hotspots" that can be remediated. The method allows for sampling coverage of a large area while attempting to hold down analytical costs. If there is sufficient evidence to expect that pesticide contamination is likely at a site, it may be advantageous to conduct this sampling protocol concurrently with the Phase II assessment.

Sample site selection should be biased in order to maximize detection of agrochemicals in cultivated soils by sampling the entire cultivated area when possible. Random sampling on properties characterized by a mixed land use is not likely to provide the greatest degree of representation regarding contamination commonly associated with agricultural production (*i.e.*, insecticides, herbicides, fungicides, fertilizers, etc.). Prior to developing a sampling strategy, each property's land use should be reviewed in terms of spatial and temporal variables, placing the greatest sampling priority on those areas which were intensively managed for agricultural production (e.g., cultivated fields). Conversely, a lesser priority should be given to rangelands and abandoned or vacant lots which have limited or no historical agricultural land uses. Some exceptions to this rationale would include commercial and industrial land uses which are sparsely distributed within the geographic areas currently under consideration for incorporation into CERP projects. In most cases, the use of random sampling is limited to those properties demonstrating homogeneous land use across the majority of the property.

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A. Sample collection

Soil samples will be collected using a stainless steel spoon or hand auger from 0-6 inches below land surface. This interval represents the biologically relevant depth for interaction with surface water and biological receptors. It is important that care is taken not to include sample material from more than 6 inches deep, as this may result in dilution and underestimation of contaminant concentrations. Between samples, sampling equipment should be decontaminated using standard procedures to prevent cross-contamination between samples. (Decontamination between subsamples (see below) will not be necessary because subsamples will be mixed together to form a composite.) Immediately following collection, samples should be placed on ice and submitted as soon as possible to the laboratory for analysis.

Before being placed in the sample jar, all soil samples (discreets and composites) should be thoroughly homogenized until they appear completely uniform in texture and color. Analytical laboratories should be instructed that samples received from the field should be thoroughly homogenized again in the jar before an aliquot is removed for extraction.

B. Analytical parameters

If it has been determined during the Phase I/II that a property has a history of agricultural activity prior to 1985, then each soil analysis should include, at a minimum, organochlorine pesticides (EPA Method 8081), metals (including mercury and copper), and total organic carbon (TOC). If the history of the property or more recent uses suggest that other contaminants may be present, then the list of analytes should be expanded as appropriate. The best available detection limits should be requested of the analytical laboratory, but at a minimum, detection limits (practical quantitation limits) for each chemical should be as low as the corresponding screening value (see below). As a general rule, TOC analysis should be done for all soil and sediment samples. TOC is essential for food chain modeling and interpretation of individual sample results, bioassay results, etc.

C. Discreet sampling for small properties (<500 acres)

Discreet sampling will be required for agricultural areas less than 500 acres in size. Discreet sample sites should be established at regular intervals across the property, at a density of at least one sample per 10-20 acres. The actual sampling density will depend on the size of the property, analytical cost per sample, likelihood of contamination, and other factors, and will be specified in the proposed sampling plan and agreed to by consensus between the District and the Service. A minimum of 10 samples will be necessary for most properties. Some exceptions to this minimum sample size will occur where parcels are small (<100 acres) or demonstrate a combination of land uses (i.e., residential "ranchettes", small scale livestock/garden/nursery properties, rock mining pits, etc.) where only a small percentage of the overall area was cultivated. Careful consideration should be given prior to using a sample size smaller than 10. As sample size decreases, statistical variation tends to increase, thereby increasing the size of confidence intervals used to determine the 95 percent UCL of the mean for any given analyte.

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Higher UCL values may increase the probability that samples will exceed ecological screening values, thereby necessitating expanded sampling, risk assessment, and subsequent clean up. Also, higher UCL values will generate correspondingly higher Hazard Quotients (HQ) in food chain modeling exercises associated with Ecological Risk Assessments (ERA).

Within this framework, actual sample location is at the discretion of the project manager. This agricultural field sampling is in addition to, and separate from, Phase II sampling that may be focusing on facilities with a high likelihood of contamination, such as pump stations, storage sheds, mixing/loading areas, airstrips, vehicle turn-arounds, cattle dip tanks, etc. The exact location of each sample should be recorded using GPS.

D. Composite sampling for large properties (>500 acres)

The large size of some of the properties being acquired (up to 20,000 acres) makes it difficult to characterize contaminant distribution and concentrations with confidence while staying within a reasonable cost. In order to address this problem, the following sampling strategy has been developed jointly by the Service and South Florida Water Management District (District).

Using aerial photographs, a 50-acre grid pattern will be established on each property or agricultural area greater than 500 acres in size. The grids should be located and confirmed in the field using GPS. Using a random number generator, specific 50-acre grids will be selected for sampling. The number of grids selected will depend on the size of the property. Obviously, the most desirable situation would be complete coverage of all present and former agricultural areas. For example, for a 1000-acre parcel, all 20 of the 50-acre grids would be sampled. For a very large property where complete coverage is not possible due to budget constraints, a pre-arranged fraction of the 50-acre grids should be selected. For example, a 5000-acre parcel would be divided into 100, 50-acre grids. Perhaps half (50) of these grids would then be randomly selected for sampling. The number of grids to be selected will be pre-determined for each site by consensus between the District and the Service, based on site-specific factors.

Each of the 50-acre areas will be subdivided into ten 5-acre plots. One soil sample will be collected from each of the 5-acre plots in the 50-acre grid. The location of each subsample should be exactly determined using GPS. The 10 subsamples are then composited into one sample and thoroughly mixed. This composite sample, representing the entire 50-acre grid, is then submitted to the laboratory for analysis and/or testing.

E. Ecological screening values

Ecological screening values are used to identify areas that may require further attention. The Florida Department of Environmental Protection's (FDEP) Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters (MacDonald et al. 2003) should be used as screening values whenever possible. The SQAGs were developed for assessing sediment quality in Florida waters, based on the probability of effects on aquatic organisms. For each contaminant there are two SQAGs: Threshold Effect Concentration (TEC) and Probable Effect

Concentration (PEC). TECs were formulated to define concentrations of contaminants below which biological effects are not expected. PECs were developed to define ranges of concentrations above which biological effects are likely.

In most cases the TEC will serve as the initial screening value, especially when using the composite-random sampling design. Use of PECs as screening values may be justified under some circumstances for certain contaminants. For some contaminants, SQAGs have not yet been developed. The U.S. Environmental Protection Agency's Ecotox Thresholds (USEPA, 1996), the National Oceanic and Atmospheric Administration's ER-Ls and ER-Ms (Long and Morgan, 1990), or other ecologically-based guidelines should be used when SQAGs are not available. For some chemicals such as metals, information on natural background levels may have to be considered. Human health-based guidelines for cleanup of contaminated sites, such as FDEP's Soil Cleanup Target Levels, should not be used for this purpose.

F. Sites which exceed the PEC

Sediments with concentrations of contaminants above the PEC are considered to represent significant and immediate hazards to exposed organisms. If any of the 50-acre composite samples, described above, exceeds the PEC or other appropriate probable effect-level screening value, it will be necessary to return to that 50-acre grid and obtain individual samples from each of the ten 5-acre sub-areas, which together formed the original composite. These samples should be taken as close as possible to the original sample locations. These discreet samples should then be submitted to the laboratory for analysis. The purpose of this follow-up sampling is to determine the distribution of contaminants within the 50-acre grid; i.e. do the data indicate the presence of one or more "hotspots," or is the contaminant(s) more or less evenly distributed over the site. If only one or two of the individual (5-acre) samples are elevated, the District may choose to remediate these areas in order to reduce the contaminant levels of the 50-acre grid to below PEC. Conversely, follow-up sampling may indicate that most or all of the 50-acre grids contain elevated levels of contaminants. Remediation of widespread contamination over such a large area may not be practical. In such a case, further testing and completion of an ecological risk assessment (ERA) will be necessary in order to refine our understanding of the hazards to federal trust resources associated with contaminants on the site. These tests and assessments should include: (1) elutriate studies, (2) sediment bioassays, and (3) ERA with food chain modeling. In addition, if any of the contaminants have a tendency to accumulate in aquatic organisms or biomagnify in the food chain, such as organochlorine pesticides, PCBs, PCDDs/PCDFs, and some metals, bioaccumulation studies are recommended. Specific tests and methods to be used are discussed in the following sections.

As stated above, follow-up sampling of discreet locations within a 50-acre grid is intended to determine the distribution of contaminants within the grid, and should not constitute an attempt to confirm or refute the original composite result. If widely disparate results are obtained upon follow-up (discreet) sampling compared with the original composite, this suggests that some error has occurred in sampling, homogenization, or laboratory analysis. In these cases, the original composite result will represent the 50-acre grid in question, barring some evidence to the contrary suggesting that the follow-up result is actually more representative of contaminant concentrations in the grid.

In order to avoid the above situation, it is strongly recommended that discreet samples collected in the field, following homogenization, be split into two jars. One sample jar will be used for producing the composite by mixing with the other samples representing a particular 50-acre grid; the other jar of each pair would be stored at 4 degrees centigrade for possible future analyses. If screening levels for any analytes of interest are exceeded in the composite sample analyses, then all 10 of the subsample aliquots used to make that sample will be reanalyzed for the observed compounds to identify more precisely the location of the observed contaminant(s). Of course, use of this methodolgy may be problematic for very large properties due to limited storage space.

G. Sites which exceed only the TEC

In general, a few scattered exceedances of a TEC by an individual contaminant at a site, when there are no PECs exceeded, is not considered to be a significant cause for concern. However, if enough samples exceed the TEC, such that the mean (estimated by the 95 percent upper confidence limit (UCL) of the mean) for the entire site (i.e., the mean of all discreet samples for a small site, or the mean of all 50-acre composites for a large site) is above the TEC, serious widespread ecological effects are possible. To evaluate this, the mean and the 95 percent UCL of the mean should be calculated for each contaminant of concern. In most cases, if the 95 percent UCL for all contaminants is below the TEC, no further action will be necessary. However, if the 95 percent UCL for any contaminant exceeds the TEC, then the additional testing and an ERA (as described above for PEC exceedances) will be necessary. These tests and assessments should include: (1) elutriate studies, (2) sediment bioassays, (3) ERA with food chain modeling, and (4) bioaccumulation studies for lipophilic contaminants. In addition, if TECs are exceeded by more than one contaminant in the same grid(s), further testing and studies will be necessary to address possible synergistic or additive effects of these co-contaminants. Bioassays will be useful in this case to identify potential toxicity from multiple contaminants that would not be predicted by using individual screening values. Specific tests and methods to be used are discussed in the following sections.

V. Desorption Studies

Contaminated soils inundated during the process of wetland restoration may release soil bound pollutants into the pore and surface waters. Soil or sediment characteristics governing pollutant desorption (e.g., total organic carbon, grain size, pH) will vary among locations. In addition, weathering or aging of some contaminants may alter their bioavailability from that predicted in the published literature. This necessitates site-specific desorption studies to accurately assess pollutant availability to aquatic organisms. Pollutant desorption is assessed on soils from the location using ASTM method E-1195-01, "Method for Determining a Sorption Constant (Koc) for an Organic Chemical in Soil and Sediments." This method simulates flooding of site soils and measures release of contaminants from the soil over time. Filtered pore water samples are collected and analyzed for COCs after 3, 7, 14, and 21 days contact time. These results are used to determine a site-specific organic carbon partitioning coefficient (Koc), an estimate of pollutant partitioning between sediments and water. This value can be used in food chain models for predicting aquatic and terrestrial organism exposure to pollutants.

Soils used in the desorption study should represent, as near as possible, the maximum detected concentration of the contaminant on the site, in order to ensure that measurable levels of the particular COC are released into the water. Bulk soil samples collected for this purpose must be thoroughly mixed. To ensure uniform contaminant concentrations, samples should be collected and analyzed from several locations within the bulk soil sample (e.g., top, middle, and bottom of the container). In order to be useful, the water analysis results must show evidence that steady-state concentrations have been reached within the 21-day duration of the test. Contaminant concentrations in water obtained during the desorption study may be compared with Florida Surface Water Quality Standards.

VI. Sediment Toxicity Testing

Toxicity testing with representative aquatic invertebrates and vertebrates allows prediction of soil bound pollutant toxicity to aquatic organisms if the location is converted to a wetland. For properties requiring an ecological risk assessment, the following sediment toxicity tests should be conducted:

1. Amphipod (*Hyalella azteca*) 10-day sediment bioassay (flow-through)
2. Midge (*Chironomus tentans*) 10-day sediment bioassay (flow-through)
3. Fathead minnow (*Pimephales promelas*) 7-day sediment bioassay (static renewal)

"Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates (ASTM E-1706-95)," "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates (USEPA/600-R-99/064)," and "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (USEPA/600/4-91/002)" provide standard methods to assess soil-associated pollutant effects upon aquatic organisms.

Endpoints measured in these tests are survival and growth. Any statistically significant impacts upon these endpoints in any test are considered direct evidence of potential impairment of the prospective benthic/aquatic community in the restored wetland.

As with the other sediment studies, bulk soil samples collected for this purpose must be thoroughly mixed, and uniformity of contaminant concentrations should be confirmed by sampling from several locations within the bulk soil sample. Soils used in the sediment toxicity tests should represent, as near as possible, the maximum detected concentration of the contaminant on the site.

VII. Bioaccumulation Studies

Factors affecting pollutant accumulation by aquatic organisms can vary among locations. Accurate prediction of pollutant bioaccumulation at a location requires site-specific bioaccumulation studies, using species representative of those that may exist on the location once flooded. For properties requiring an ecological risk assessment, the following bioaccumulation studies should be conducted:

1. Oligochaete (*Lumbriculus variegatus*) 28-day bioaccumulation study
2. Fathead minnow (*Pimephales promelas*) 28-day bioaccumulation study

Methods described in "Great Lakes Dredged Material Testing and Evaluation Manual (USEPA and Army Corps of Engineers, 1998)" and "Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates (ASTM E-1688)" should be used to determine the bioaccumulation potential of soil-associated pollutants. These results are used to determine a site-specific octanol-water partitioning coefficient (Kow), an estimate of pollutant partitioning (bioconcentration) between water and the body fat of the exposed organism. This information is utilized in food chain models for estimating contaminant uptake from water and accumulation in various trophic levels.

Soils used in the bioaccumulation studies should represent, as near as possible, the maximum detected concentration of the contaminant on the site, in order to ensure that measurable levels of the particular COC are released into the water and taken up by the organisms. Bulk soil samples collected for this purpose must be thoroughly mixed. To ensure uniform contaminant concentrations, samples should be collected and analyzed from several locations within the bulk soil sample (e.g., top, middle, and bottom of the container). In order to be useful, the concentration of contaminant(s) in the test organisms must show evidence that steady-state conditions have been reached within the 28-day duration of the test.

VIII. Aquatic Food Chain Modeling

In the absence of direct measures of effects, it becomes necessary to estimate or predict potential pollutant effects upon the Service's trust resources and other organisms that may utilize the created wetland, reservoir, or STA. Testing that directly assesses soil bound pollutant toxicity to organisms, other than benthic invertebrates and fish, is relatively time consuming and costly. Food chain models allow prediction of effects on higher level organisms by combining data from the site-specific desorption and bioaccumulation studies with information on dietary composition, consumption rates, body weights, etc. and literature toxicity data.

The Service's trust resources include migratory birds and Federally listed threatened or endangered species. The bald eagle (*Haliaeetus leucocephalus*), white pelican (*Pelecanus erythrorhynchos*), snail kite (*Rostrhamus sociabilis*), osprey (*Pandion haliaetus*), clapper rail (*Rallus longirostris*), and wood stork (*Mycteria americana*) are federal trust species that should be considered as representative target organisms. Where bioaccumulating pollutants are present,

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a maximally exposed piscivorous bird must always be included. Generic fish species (omnivorous and higher level predatory fish) may be used as aquatic focal species. At a minimum, the food chain model should assess risk to the following groups (trophic levels) of target organisms:

1. Benthic invertebrates (detritivores)
2. Omnivorous fish
3. 1st order carnivorous fish (trophic level 3)
4. 2nd order carnivorous fish (trophic level 4)
5. Omnivorous bird
6. 1st order carnivorous bird
7. 2nd order carnivorous bird
8. Threatened and endangered species

The following potential routes of exposure should be included in the model:

1. Direct exposure to contaminated water/sediments
2. Sediment ingestion
3. Water ingestion
4. Food ingestion

The following transfer mechanisms and processes should be included:

1. Desorption from sediment to water
2. Bioconcentration from water
3. Bioaccumulation through ingestion of contaminated prey
4. Biomagnification with increasing trophic level

Once the target species' exposure to pollutants has been modeled, the potential risk to the species needs to be assessed by comparing the modeled exposure to a toxicity reference value (TRV). Perhaps the most relevant endpoints for assessing risk are effects upon (1) survival and (2) reproduction. In the absence of toxicity tests performed with the specific target species, TRVs for the pollutant(s) of interest must be obtained from the literature. Where possible, the ideal TRV will have been generated using a similar exposure route for a taxonomically related species. Uncertainties arising from the use of TRVs based on different exposure routes or unrelated species should be discussed in the risk assessment. In general, the most sensitive TRV should be utilized to assess risk to the target species.

Risk is expressed by calculating a hazard quotient (HQ), which is simply the ratio of the modeled exposure (numerator) and TRV (denominator). HQs above one indicate a potential for adverse effects to occur in a species under a given exposure scenario. The higher the HQ above one, the greater the risk that adverse effects will occur. HQs below one generally indicate that adverse effects are unlikely. HQs that are greatly different from one provide the greatest level of certainty in their interpretation.

IX. Final Report

Upon completion of all sampling, chemical analyses, laboratory studies, and food chain modeling, a draft Phase I/II Environmental Site Assessment and Ecological Risk Assessment report should be prepared which identifies all potential hazards to ecological receptors and provides recommendations for corrective actions and/or management of the project that will reduce the hazards to acceptable levels. The Service will review the draft report and provide concurrence or make recommendations for changes or additions. The final report will incorporate Service recommendations, providing an accurate and complete report which can be used as a planning tool to optimize wetland restoration efforts and minimize adverse affects to fish and wildlife resources.

Literature Cited

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Appendix B

District Guidance in the Design of a Project-level Monitoring and Assessment Plan for Mercury, Pesticides and Other Toxicants

District Guidance in the Design of a Project-level Monitoring and Assessment Plan for Mercury, Pesticides and Other Toxicants

INTRODUCTION

This document is intended to guide in the design of monitoring and assessment plans for mercury (Hg), pesticides, and other toxicants for South Florida Water Management District (District or SFWMD) projects. Because Hg is a regional problem in South Florida, it should be a consideration in all plans. As discussed below, although pesticides or other toxicants are often found dispersed in various media throughout South Florida (e.g., water, sediment, biota), concentrations do not frequently exceed critical levels that are thought to result in toxicity. Therefore, risk from exposure to pesticides or other toxicants tends to be a more localized concern than for mercury. More importantly in this context, the risk from changes related to the Comprehensive Everglades Restoration Plan (CERP) increasing the likelihood that wildlife will be exposed to these constituents, to a level that is toxic, also tends to be a localized concern. Accordingly, monitoring pesticides or other toxicants should be considered on a case-by-case basis.

It is not the intent of this plan to substitute for environmental site assessments (ESA) that are conducted on acquisition tracts. The District has an excellent record in conducting ESAs, site-specific environmental risk assessments (ERA), and implementation of corrective actions, where appropriate. This guidance has been prepared in consultation with and, where possible, will be implemented in coordination with the District's program for assessing the environmental liabilities associated with land transfer. However, the potential for anomalous methylmercury (MeHg) production is not considered during the ESA and thus must be assessed separately. With regard to other toxicants, the guidance provided here should prove useful in cases where either:

- an ESA identified dispersed low-level contamination of toxicants and there is a need to reduce uncertainties, i.e., better define spatial or vertical distribution,
- where lands were purchased by other public / private entities, but may not have been subjected to the same level of ESA as current transfers,
- there has been a lengthy interval between the time of assessment and start of construction (with interim usage by a lessee), or
- where pesticides or other toxicants have previously been identified as a concern on public lands (i.e., possibly as a result of stormwater runoff).

Results from the monitoring and assessment plan, in combination with information generated during land transfers, is intended to provide state and federal regulatory and trust oversight agencies with reasonable assurance that the project will not cause or contribute to an unacceptable increase in the risk of toxic effects to aquatic or terrestrial resources. As discussed below, the current numerical water quality standard (WQS) for total mercury (THg) is not protective of human or wildlife health. Consequently, assessments will need to place greater weight on protecting designated beneficial uses, i.e., recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. This will also be true for other toxicants that can be released suddenly from flooded soils and/or that have the potential to biomagnify. In addition to numerical water quality standards, assessments will need to consider Line 62 of

62-302.530, Florida Administrative Code (F.A.C.), which states that substances in concentrations which injure, are chronically toxic to, or produce adverse physiological or behavioral response in humans, plants, or animals shall not be present. In addition to state requirements, federal legislation that may be pertinent include the Comprehensive Environmental Response, Compensation and Liability Act, the Endangered Species Act, and/or, the Migratory Bird Treaty Act.

This guidance uses a phased, multi-tiered approach that is intended to commit information gathering, assessment, and remedial resources in proportion to the likelihood of harm by following a logical and cost-effective procedure. The plan covers three phases of a project: (1) Baseline Collection and Assessment, (2) Monitoring during the Three-Year Stabilization Period, and (3) Routine Operational Monitoring (Post-Stabilization). The plan includes decision points and adaptive management recommendations if preconstruction or operational monitoring reveals conditions of immediate concern. If an identified threshold of concern (i.e., action level) is crossed, then Tier 2 expanded monitoring and risk assessment would be triggered to determine the cause and guide appropriate adaptive management decision making regarding short-term corrective actions and long-term operational optimization. The intent of this approach is to allow monitoring efforts to smoothly ramp down or up, as appropriate.

This general plan is intended to accommodate diverse projects by providing a framework that can be tailored to a project's specific design. For example, a monitoring and assessment plan for a wetland restoration project would likely differ substantially from a plan for a Stormwater Treatment Area (STA) or reservoir. While it is anticipated that this guidance will serve as a frame of reference for future permit-mandated monitoring, incorporation of all, some, or none of its elements into a permit is at the discretion of the responsible authorities.

Mercury

Although atmospheric loading is often the dominant proximate source of inorganic mercury to many water bodies, the complication lies in the relationship between influx of inorganic mercury and the amount that is methylated by sulfate-reducing bacteria (SRB) following deposition. The latter process is of fundamental concern because MeHg is the more toxic and bioaccumulative form that can build up in the food chain to levels harmful to humans and other fish-eating animals, particularly in ecosystems with complex, lengthy food chains. Accordingly, a monitoring and assessment plan must be able to detect increased amounts of MeHg in the project area or downstream waters, either through sedimentary release of THg or MeHg, or through increased net Hg methylation. Although there are some constraints in predicting outcomes, the following factors are thought to be associated with increased MeHg production, particularly when in combination with certain site conditions (i.e., sediment biogeochemistry that is, as yet, less well-defined):

- Increased proportion of source water from direct rainfall relative to surface water runoff (explanatory note: rain contains elevated levels of bioavailable inorganic Hg, particularly during summer; whereas, surface water runoff has already lost Hg through evasion back to atmosphere, sorption and deposition, and biological uptake);
- Elevated levels of oxidized sulfur compounds (e.g., sulfate, etc.) in inflows or sediments (explanatory note: used as electron acceptor by SRBs);
- Drawdown – drying followed by rewetting (explanatory note: allows constituents in the sediments/soils to oxidize); or
- Large bioavailable carbon source (explanatory note: feeds SRBs).

The goal is to prevent these factors from combining to produce a mercury methylation hot spot both in the short term (known as the "first-flush effect") and the long term (known as the "reservoir effect"). For additional details, see evolving conceptual model presented in the Fink et al., 1999; Stober et al., 2001; Harris et al., 2003; Atkeson and Axelrad, 2004.

The Florida Department of Environmental Protection (FDEP) has recognized that the current Florida numerical water quality criterion of 12 nanograms of total mercury (THg) per liter (ng/L) in water is of limited use, because fish consumption advisories have proven necessary for waters meeting the state criterion (Atkeson and Parks, 2002). Likewise, the U.S. Environmental Protection Agency (USEPA), also recognizing the limited utility of its recommended water quality criterion for the protection of human health, recently published guidance on a new criterion expressed not as a water-column concentration of mercury, but as a concentration of mercury in fish tissue (0.3 milligrams per kilogram, or mg/kg in fish tissue; USEPA, 2001). Biomonitoring mercury provides several advantages. First, MeHg occurs at much greater concentrations in fish tissues relative to surrounding water, making chemical analysis more accurate, precise, and cost-effective. Second, organisms integrate exposure to MeHg over space and time, while corresponding water concentrations may vary by a factor of two or more over a period of hours. Finally, the tissue Hg concentration in fish is a true measure of its bioavailability and provides a much better indicator of possible exposure to fish-eating wildlife and humans than the concentration in water.

In anticipation of the state adopting a new WQS based on tissue concentration and because it is cost-effective, this generic plan has a biomonitoring program as a key component. The long-term goal is to reduce tissue Hg concentrations in predatory fish to levels that do not exceed USEPA guidance values for the protection of both human health and wildlife (for guidance values to protect wildlife, see USEPA, 1997). However, it should be recognized that the Everglades has a preexisting, widespread mercury problem (i.e., fish from most areas currently exceed one or more predatory protection criteria) and that many of the influential factors controlling MeHg production are beyond the scope of individual projects. Accordingly, use of USEPA's guidance criterion as a "risk-based" action levels is not appropriate in the short term. Instead, monitoring and assessment plans will track the status and trends of mercury bioaccumulation to ensure that it does not significantly increase over baseline levels. This monitoring and assessment plan incorporates action levels or triggers for decision points based on existing reference or baseline conditions (i.e., annual basin-wide arithmetic average or percentile concentration for all basins pooled). For purposes of pooling related data, the basin will be operationally defined based on the physiography and land uses of the watershed, category of water body (e.g., wetland, slough, open lake, etc.), and the data set available at that time. Ideally, the data set would allow for comparisons between similar habitat or sediment types. However, near-term projects may not have this option and may need to collect reference samples (especially where data on similar sediment types are unavailable) or use surrogate data collected at Stormwater Treatment Areas or Water Conservation Areas under the Everglades Forever Act Permits for comparative purposes.

Pesticides and Other Toxicants

Potential impacts to wildlife from exposure to toxicants other than mercury (e.g., organic pesticides or trace metals) continues to be a problem. This is of particular concern in Florida because of its complex stormwater management system from both urban (e.g., lawns, golf courses, "street dust") and agriculture, high groundwater table, and significant usage of a wide variety of pesticides and fertilizers. Fertilizers (including organic and biosolids) are a concern because several studies have measured heavy metals (e.g., cadmium, lead, nickel, and copper) in mineral ores and the resulting fertilizers (USEPA, 1999). Like mercury, many other toxicants, including relic (e.g., DDT, DDE, toxaphene, etc.) and new (e.g., atrazine, alachlor) pesticides, have been found to be atmospherically deposited from both local and global sources (for details, see Eisenreich et al., 1981; Goolsby et al., 1993). Consequently, source identification can be challenging.

Owing to their absorptive capacity, soils and sediments typically act as a sink for these contaminants. As long as these soils/sediments maintain the capacity to store and thus immobilize the potential toxicant, the effects are significantly reduced. However, any alteration in the environment (e.g., flooding, anoxia and redox, microbial processes, pH changes) can suddenly reduce the sediment's storage capacity, which in turn can result in serious environmental damage (see "Chemical Time Bomb" concept in Stigliani et al., 1991).

Pesticides have been detected in sediments and surface water at District structures at various times (Miles and Pfeuffer, 1997; Pfeuffer and Matson, 2003; Pfeuffer and Rand, 2004). Likewise, pesticide residues have been found in fish and wildlife from certain locations in the central and southern Everglades (USGS National Water Quality Assessment Program at http://fl.water.usgs.gov/Abstracts/fs110_97_haag.html; Rumbold et al. 1996, Spalding et al. 1997, Rodgers 1997, Fernandez et al. 2003). Recently, a bird kill in excess of 800 birds occurred on Lake Apopka, possibly as a result of pesticide poisoning, after former farmlands were flooded (see Memorandum of Understanding between U.S. Department of Justice and St. John's River Water Management District, available at http://sjr.state.fl.us/programs/acq_restoration/s_water/lapopka/MOU.html).

The monitoring and assessment plan for other toxicants often takes advantage of the mercury monitoring program, as in many cases, additional work simply involves splitting samples.

MONITORING AND ASSESSMENT FRAMEWORK

1. Phase 1 - Baseline Collection and Assessment

This section describes activities conducted during the initial stages of a project. In some cases, a Project Manager may opt to carry out these activities prior to site selection (i.e., on short-listed sites) to provide additional information to guide in the selection process. If site selection has already occurred, then a Project Manager may elect to carry out these tests to assist in selecting the final design (e.g., footprint or operational features). As previously stated, it is not the intent of this plan to substitute for ESAs that are conducted on acquisition tracts. Results of those assessments are routinely reviewed and receive necessary approvals from the FDEP and the U.S. Fish and Wildlife Service. Accordingly, where an ESA has recently been completed, baseline collection and assessment of toxicants other than Hg is not a general recommendation beyond the Phase 1 - Tier 1 task of compiling and reviewing existing data. Although these tests are a general recommendation for mercury, it should be understood that due to current limitations in predicting methylation potential, results of these tests should not be the sole factor in making site or design selection. Nonetheless, information gathered during this phase of the project will be crucial in developing the final monitoring plan and as baseline for future, post-construction cause-and-effect assessments.

1. 1 Phase 1 - Tier 1: Compilation and Review of Available Data

The first step in any project is to compile and review all available data (e.g., ESA, DBHYDRO, Battelle Monitoring Data Inventory) collected from the project footprint and surrounding area. With regard to other toxicants, data should be reviewed to answer the following questions:

- If land transfer, responsible agency and level of ESA preformed (i.e., Phase 1 or 2)?
- Did the ESA identify contaminants of concern?
- Were any corrective actions taken and was there follow-up sampling?
- Was there dispersed low-level contamination of toxicants (i.e., that did not exceed the requirements for corrective action)?
- Has there been a lengthy interval between the time of assessment and start of construction (with interim usage by a lessee) and, if so, what chemicals may have been used in the interim?
- If public lands, have toxicants been previously identified based on surface water, sediment or fish monitoring?

Answers to these questions will guide in developing an abbreviated analyte list for subsequent monitoring.

In areas that have been extensively studied, projects may have adequate baseline datasets and thus may not be required to collect any additional data before developing the Phase 2 monitoring and assessment plan. Alternatively, where datagaps exist or where the preponderance of the baseline data demonstrate a potential problem, additional sampling (i.e., under Phase 1 - Tier 2 or Tier 3) may be necessary.

1. 2. Phase 1 - Tier 2: Field Sampling

1. 2.a Soil/Sediment

To describe conditions within each project, it is recommended that soil/sediment cores be collected from five locations within each operable unit (i.e., OU - each independently operated treatment train of an STA or reservoir) or each 1,000-acre parcel, whichever is smaller. At each location or site, three cores from the 0-to-4 cm horizon are to be collected and composited as a single soil sample. To conserve resources at large projects, sub-samples or aliquots from each of the soil samples from the five different locations can be pooled to form a single supercomposite sample for each OU or 1,000 acres. In this two-staged sampling approach, the analyses of the supercomposite representing the entire OU or 1,000 acres can be used as a screening mechanism to identify if additional, individual analysis are need to be performed (on each of the individual soil/sediment samples). Accordingly, remaining material from each soil sample will be archived separately for up to one year to allow for possible future analysis.

If the site was flooded and sediments had been saturated for some period of time (i.e., in excess of a month) with water comparable to future source water, then sediments may be immediately analyzed for THg, MeHg, moisture content, total organic carbon (TOC), total sulfur (TS), and total iron (TFe). Alternatively, if soils were collected from a dry site (i.e., orange grove, range land, etc.), then baseline concentrations will not reflect future flooded conditions (i.e., potential for MeHg production or first flush). Accordingly, soil/sediment must first be incubated with source water (i.e., surface water containing ambient concentrations of sulfate and dissolved organic carbon mixed with rainwater containing bioavailable inorganic Hg) for a period to evaluate this potential for first flush and future MeHg production. This test (i.e., beaker-scale microcosm test) will use fresh soils (i.e., the supercomposite from above) and ambient water from the anticipated inflows (i.e., appropriate mixture of surface water and rainfall, which have been subsampled for analysis for THg and MeHg), and will be run under static conditions, with frequent renewal. Upon completion of the test, sediments will be collected and analyzed for THg, MeHg, moisture content, TOC, TS, and TFe.

If deemed necessary, based on the discussion above, soil/sediment samples (wet or dry) could also be split and analyzed for toxicants of concern identified either through an ESA, available water quality (WQ) database or, if these were unavailable, previous land uses (both upstream and within the footprint). Although this course sampling would likely miss possible "hot spots" (e.g., fuel loading or pesticide mixing zones), which should have been detected during the ESA (when cores were collected from 5-acre subparcels and composited for randomly selected 50-acre parcels), this level of detail should be sufficient to characterize dispersed contaminants.

The objective of screening for toxicants is (1) to prevent direct toxicity, either acute or chronic, and (2) to prevent the biomagnification of toxicants from reaching unacceptable levels that would pose a threat to upper trophic level wildlife. To achieve the first objective, toxicants would be evaluated against effects-based, numerical sediment quality assessment guidelines (SQAGs for sediment dwelling organisms, MacDonald Environmental Sciences Ltd.; USGS, 2003). In cases where the effects-based SQAG did not assess the potential for adverse effects on aquatic organisms due to the resuspension of sediments or partitioning of contaminants into water (i.e., using elutriates or pore water), soils may be subjected to a synthetic precipitate leaching procedure (SPLP; USEPA Method 1312, also see Brannon et al., 1994) using ambient source water to elute the column and the resulting elutriate assessed based on Chapter 62-302, F.A.C. (and other references contained in Pfeuffer and Matson, 2003); exceedances would trigger Tier 3 assessments. To achieve the second objective, bioaccumulative toxicants would also be evaluated against established bioaccumulative-based SQAGs, if available (MacDonald Environmental Sciences Ltd.; USGS, 2003).

A project would stop and reevaluate the ESA (if completed) and/or proceed to Phase 1 - Tier 3 bioaccumulation tests and dynamic modeling if:

- concentrations in sediments exceeded the appropriate SQAG,
- concentrations in sediments exceeded a value reported in the ESA or a level that was determined to be critical in a site-specific risk assessment, or
- the concentration in the elutriate exceeded a WQS in Chapter 62-302, F.A.C.

Although bioaccumulation-based SQAGs have been developed for a limited number of toxicants, there is no chemical-specific SQAG for mercury. Consequently, there is no screening-level benchmark sediment THg or MeHg concentration that can be used to confidently predict whether a site will become a "MeHg" hotspot. However, data collected over the last nine years by various agencies working in the Everglades offer some limited capability as a reference (or baseline) to predict the potential for excessive MeHg production. Accordingly, as one of several potential tools for alternatives analysis, it is recommended that soil/sediment conditions of the site be assessed for MeHg production potential through comparisons with this reference database. If absolute concentrations of MeHg, or percent MeHg (i.e., percentage of THg that is in the MeHg form) in soils/sediment from an OU exceeds the 90% upper confidence interval for within basin sediments or, if not available, the 90^{th} percentile concentration (or %MeHg) for all basins, then the potential exists for excessive MeHg production and, accordingly, it is recommended that the project proceed to Phase 1 - Tier 3.

As previously discussed, a great deal of uncertainty remains surrounding the use of soil/sediment concentrations as a predictive tool to forecast future MeHg potential. Accordingly, as discussed in the following section, it is recommended that resident fish also be collected to assess current MeHg production and bioaccumulation.

1. 2.b Fish Tissues

At a minimum, fish samples from multiple trophic levels should be collected upstream and downstream of each project. Specifically, a sample of at least 100 mosquitofish (*Gambusia spp.*) should be collected from each location and composited into a single sample for THg analysis. Additionally, individual sunfish [sample size (n) should be greater than or equal to 5; whole-body] should be collected from each location and analyzed for THg. Where habitat will support largemouth bass (*Micropterus salmiodes*) and there is a possibility of future recreational harvesting, bass should also be collected and individually analyzed for THg (n should be greater than or equal to 5; fillets). Becasue virtually all (> 85 percent) of the mercury in fish muscle tissues is in the methylated form (Grieb et al., 1990; Bloom, 1992; SFWMD, unpublished data), the analysis of fish tissue for THg, which is a more straightforward and less-costly procedure than for MeHg, can be interpreted as being equivalent to the analysis of MeHg.

To reduce variance (i.e., due to species related differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections should target bluegill (*Lepomis macrochirus*) ranging in size from 102 to 178 mm (i.e., 4-7 inches) and largemouth bass ranging in size from 280 to 330 mm (i.e., 11 to 13 inches); however, other lepomids (first priority being given to spotted sunfish, *L. punctatus*, due to similar trophic status) or sizes are to be collected if efforts fail to locate targeted fish. If neither sunfish nor bass are present, then consideration should be given to sampling other species.

In addition, if possible (i.e., if flooded), mosquitofish should also be collected randomly from multiple locations from each OU or 1,000 acres (total should exceed 100 mosquitofish) and physically composited to form a single mosquitofish sample representative of the entire OU.

Body burdens in upstream and downstream fish do not provide predictive capabilities for alternatives analysis; however, this data set will be a crucial baseline for trend analyses following initiation of flow-through operation. Alternatively, ambient fish from the interior or footprint do provide some predictive capabilities for alternatives analysis. If these mosquitofish demonstrate excessive levels of MeHg bioaccumulation that exceed the 90% upper confidence level of the basin-wide annual average (reference basin will be defined for each specific project) or the 90th percentile concentration for the period of record for all basins, then it is recommended that the project proceed to Phase 1 - Tier 3: Bioaccumulation Tests and Dynamic Modeling.

If deemed necessary, based on the discussion above, fish samples could also be split and analyzed for bioaccumulative toxicants identified either through an ESA, available WQ database or, if these were unavailable, previous land uses (both upstream and within the footprint). Although, it is recognized that under certain circumstances a taxa other than fish may be more appropriate biological sentinels depending on toxicant and risk assessment endpoint, this will require a thorough justification.

If levels of other toxicants in tissues exceed recognized background tissue concentrations (USGS National Water Quality Assessment Program, etc.) or benchmarks established in ecological risk assessments completed as part of the ESA, then the project would stop and reevaluate the ESA or proceed to Tier 3 Bioaccumulation Tests and Dynamic Modeling.

1. 3. Phase 1 - Tier 3: Bioaccumulation Tests and Dynamic Modeling

Tier 3 assessments during Phase 1 Baseline Collection and Assessment are triggered if one of the following action levels are exceeded:

- If absolute concentrations of MeHg, or average percent MeHg (i.e., percentage of THg that is in the MeHg form) in soils/sediments from an OU exceeds the 90% upper confidence level of within the basin average, or if not available, the 90th percentile concentration (or %MeHg) for all basins;
- If concentrations of other toxicants in soils/sediments exceeded benchmarks established in ecological risk assessments completed as part of the ESA, or exceeded an appropriate SQAG, or the concentrations in the elutriate exceeds Chapter 62-302, F.A.C.; or
- If ambient fish collected within the project boundary demonstrate excessive bioaccumulation that exceeds the critical tissue benchmark used to establish SQAGs or in site-specific risk assessments exceeds the 90% confidence level of within the basin average, or if not available, the 90th percentile concentration for all basins.

Before proceeding to full Tier 3 sampling or modeling, the following steps are recommended to better define spatial extent of problem (i.e., to focus future efforts and thus conserve resources).

Step 1. Run analytical chemistry on the five individual soil samples that comprise the supercomposite that exceeded the trigger.

Step 2. Resample mosquitofish at a finer scale (i.e., 1 sample per 200 acres) within the OU or 1,000 acres for which the Tier 1 composite sample exceeded the trigger.

1.3.a Bioaccumulation Tests

As previously discussed, uncertainties remain surrounding the use of soil/sediment concentrations as a predictive tool to forecast future MeHg potential. Depending on soil conditions (e.g., concentration of TOC, TS, or TFe) bulk concentrations could substantially overestimate the fraction of MeHg actually bioavailable to aquatic animals living on or in surficial soils and thus the short-term MeHg bioaccumulation potential.

To reduce this uncertainty, a standardized laboratory determination of MeHg bioaccumulation (ASTM 1688-00a, E1706-00e1, or equivalent; also see Ingersoll et al., 1998; Nuutinen and Kukkonen, 1998) may be carried out using soils collected from multiple locations within the footprint of the proposed component; supercomposite from above or individual composites (if area has been defined by sediment concentrations). Because most of the cost of this test is associated with the collection of soil/sediments, a Project Manager may opt to collect sufficient soil/sediments for this test during Tier 1 sampling.

The bioaccumulation test will use soils/sediments, ambient water from the anticipated inflows (i.e., appropriate mixture of surface water and rainfall, which have been subsampled for analysis for THg and MeHg) and will be run under static conditions with frequent renewal. Current standard protocols utilize infaunal invertebrates (e.g., *Lumbriculus variegatus*, a freshwater benthic worm) and are non-feeding exposures. Therefore, assessment of food chain transfers (biomagnification) require modeling (i.e., in this case to mosquitofish or sunfish) using biomagnification factors (BMFs) from the peer-reviewed literature, if basin-specific data are unavailable. A probabilistic bioenergetics-based food chain model may be used if a valid, applicable BMF cannot be obtained (e.g., Norstrom et al., 1976; Rodgers, 1994; Korhonen et al., 1995; Schultz et al., 1995).

If Tier 3 Bioaccumulation Tests and Modeling is triggered by toxicants other than Hg on a site that has recently undergone an ESA or ERA, then the Project Manager should reevaluate early model runs and rerun with additional data. Where an SQAG (either effects-based or bioaccumulation-based) has not been identified, or in cases where an exceeded SQAG is thought to be overly conservative, it is recommended that a standardized laboratory bioaccumulation test (ASTM 1688-00a, E1706-00e1, or equivalent; also see Ingersoll et al., 1998) be performed.

1.3.b Modeling

If Phase 1 - Tier 2 evaluations or Tier 3 bioaccumulation tests demonstrate the potential for excessive MeHg production and bioaccumulation over a substantial portion of the project footprint (hence, the need to define spatial extent, as discussed above), then it is recommended that the Everglades Mercury Cycling Model (E-MCM) or comparable model be used during alternatives analysis. Preferably, model output should be considered both in terms of site selection and operational design. However, due to the current limitations in the predictive strength of the E-MCM, results of the management scenarios simulated must be considered as possible, rather than probable outcomes (Harris et al., 2004), and should not be the sole factor in site selection.

Consultants under contract to the District's Land Acquisition Department have developed and routinely use several different models for evaluating biomagnification and ecological risk from exposure to other toxicants. If resulting risk estimates (either based on uptake or critical tissue concentrations) are deemed acceptable, the project would proceed and initiate Phase 2 - Tier 1 monitoring. On the other hand, if risk is deemed to be unacceptable, then the Project Manager would proceed to determine potential remedial actions/alternatives to reduce exposure and risk.

2. Phase 2 - Monitoring During Three-Year Stabilization Period

This section describes a general monitoring and assessment plan to be conducted on projects after initial flooding and through the first three years of operation.

2.1 Phase 2 - Tier 1: Routine Monitoring During Stabilization Period

2.1.a Water

At a minimum, an unfiltered surface water sample (n = 1) should be collected in accordance with Chapter 62-160, F.A.C., at the inflows and immediately upstream of the outflows of each project on a quarterly basis and analyzed for THg, MeHg, and if not included under routine WQ monitoring, sulfate. In addition, flow will be monitored at the inflow and outflow to allow for load estimation to and from the project (it should be recognized that quarterly sampling would allow for only rough estimation of loads).

This data set will provide crucial information regarding assessment measures, i.e., annual outflow loads of THg and MeHg should not be significantly greater than inflow loads, including atmospheric loading; load estimates should include confidence intervals that describe uncertainty in measures of flow and concentration (e.g., field and analytical precision) and resulting from interpolation (note: assessment protocol to be negotiated with permitting authority). Failure to satisfy this assessment measure would trigger Tier 2 Expanded Monitoring and Risk Assessment.

Until a new criterion based on tissue concentrations is promulgated, monitoring THg in surface water will likely also be necessary to demonstrate compliance with Chapter 62-302, F.A.C. (i.e., WQS of 12 ng THg/L); however, this would trigger Tier 2 Expanded Monitoring and Risk Assessment only if the loading assessment measure was also exceeded.

It is recommended that other toxicants identified during Phase 1 - Tier 1 data review (i.e., based on ESA, DBHYDRO, Battelle Monitoring Data Inventory) be included on the analyte list for quarterly water-column sampling. Because of the concern for potential acute toxicity, the initial sample collection should occur prior to flow-through operation. Subsequent sampling would occur at the same frequency as mercury monitoring and be assessed using a similar performance measure, i.e., outflow load should not be significantly > inflow load (including atmospheric load). Because of differences in the anticipated time frames under which sedimentary release are thought to occur (i.e., relative to MeHg that may have time lag associated with changes in biogeochemistry and microbial methylation driven by water quality), monitoring for other toxicants would cease after one year, if action levels are not exceeded within that time. Exceedance of WQS in Ch.62-302 would trigger Tier 2 Expanded Monitoring and Risk Assessment.

2.1.b Soil / Sediment

Soil / sediments will not be collected under Phase 2 - Tier 1 monitoring.

2.1.c Fish Tissues

At a minimum, samples of fish from multiple trophic levels should be collected from each OU and from a single downstream site for each project. Specifically, within one month following initial flooding and quarterly thereafter, mosquitofish should be collected from multiple locations within each OU (to total at least 100 fish) and physically composited into one (spatially-averaged) sample and analyzed for THg (note, a single aliquot should be analyzed per composite). Mosquitofish were selected as a primary sentinel species because of their widespread occurrence in the Everglades, ability to invade newly flooded areas, and because of their relatively small home range and short life span. Mosquitofish are known to bioaccumulate MeHg as well as, other metals, such as lead, zinc, selenium and cadmium and organochlorine pesticides including but not limited to DDT, endosulfan, and toxaphene. These characteristics make the mosquitofish an excellent indicator of short-term, localized changes in a toxicant's bioavailablity.

On an annual basis, sunfish (n should be greater than or equal to 5) should be collected and individually analyzed (whole-fish) for THg. Sunfish were selected because of their widespread occurrence (especially bluegill) and because they are a preferred prey for a number of fish-eating species. Where habitat supports largemouth bass and there is a possibility of future recreational harvesting, bass should also be collected (n should be greater than or equal to 5) and individually analyzed (fillets) for THg. Largemouth bass can be used as an indicator of potential human exposure to mercury. To reduce variance (i.e., due to species differences in diet, ontological shifts in diet, exposure duration) and improve spatial and temporal comparisons of tissue levels within trophic levels, collections should target bluegill ranging in size from 102 to 178 mm (i.e., 4 to 7 inches) and largemouth bass ranging in size from 280 to 330 mm (i.e., 11 to 13 inches); however, other lepomids (due to similar trophic status, first priority being given to spotted sunfish) or sizes are to be collected if efforts fail to locate targeted fish.

Due to their relatively longer life spans and larger home ranges, sunfish and largemouth bass integrate their exposure over a larger spatial area and longer time frame. Accordingly, caution should be exercised when assessing levels in these fish in recently flooded (or intermittingly flooded) marshes. Under those circumstances, more weight should be placed on levels in mosquitofish which, as stated previously, integrate exposure over a shorter period of time.

If after one year of monitoring, sufficient data are collected to demonstrate that conditions within the different OUs are equivalent, collection of large-bodied fish can be reduced to one OU and one downstream site. Alternatively, if OUs are shown to differ in terms of average concentration in mosquitofish, project managers may elect to sample large-bodied fish from the OU with the highest observed concentration and assess results as "worst case". However, in either case, mosquitofish collections would continue from all OUs.

This data will then be used to evaluate the following assessment measure: annual average THg levels in fishes should not increase progressively over time or become elevated to the point of exceeding the 90% upper confidence level of the annual basin-wide average, or if basin-specific data are lacking, exceeding the 90[th] percentile concentration for the period of record for all basins. Exceedance of any of these action levels would trigger Phase 2 - Tier 2 Expanded Monitoring and Risk Assessment.

It is recommended that bioaccumulative toxicants identified during the Phase 1 - Tier 1 data review (i.e., based on information contained in the ESA, available WQ database, or previous land uses) be included on the analyte list for fish tissues collected during the first year of the stabilization period, if analytical procedures exist. For toxicants other than mercury, more weight may need to be placed on whole-body residues in mosquitofish and sunfish (that will include organs that may preferentially accumulate other toxicants) to assess ecological risk than levels in fillets of largemouth bass. Furthermore, it should also be recognized that under certain circumstances taxa other than fish may be more appropriate biological sentinels depending on the toxicant and the risk assessment endpoint. For example, preliminary discussions have taken place regarding the possible use of the apple snail (*Pomacea paludosa*) to biomonitor potential copper exposure to the endangered snail kite (*Rostrhamus sociabilis plumbeus*). However, a thorough justification will be required in any plan that targets species other than mosquitofish, sunfish, or bass.

Tissue levels of other toxicants should not increase significantly over time or become elevated to the point of exceeding the critical tissue benchmark used to establish SQAGs or in risk assessments, exceeding the 90% upper confidence level of the annual basin-wide average, or if not available, exceeding the 90[th] percentile concentration for all basins. Exceedance of these action levels would trigger Phase 2 - Tier 2 Expanded Monitoring and Risk Assessment.

2.2 Phase 2 - Tier 2: Expanded Monitoring and Risk Assessment

Phase 2 - Tier 2 is triggered if one of the following action levels is exceeded:

- If annual outflow loads of THg or MeHg are significantly greater than inflow loads (i.e., based on an uncertainty analysis of loading estimates);
- If a WQS (in Chapter 62-302, F.A.C.) for a toxicant other than mercury is exceeded;
- If annual average levels of a residue in a given fish species increases progressively over time (i.e., two or more years) ($p < 0.1$);
- If annual average Hg levels in a given fish species become elevated to the point of exceeding the 90% upper confidence level of the basin-wide average, or if basin-specific data are lacking, exceeding the 90[th] percentile concentration for the period of record for all basins; or
- If residue levels of other toxicants in fish become elevated to the point of exceeding the critical tissue benchmark used to establish SQAGs or developed in risk assessments.

The following steps will be taken if any action level in Phase 2 - Tier 2 is triggered:

Step 1: Resample media (e.g., water or fish) that triggered Tier 2.

If results of Step 1 (i.e., re-sampling of media that triggered Tier 2) demonstrate that the anomalous condition was an isolated event, the project will revert back and continue with Phase 2 - Tier 1 monitoring. Alternatively, if results of Step 1 reveal anomalous condition was not an isolated event, proceed to Step 2.

Step 2 involves expanding the monitoring program as follows:

- Increase frequency of mosquitofish collection from quarterly to monthly.
- If Tier 2 was triggered by excessive loading or exceedance of a WQS at common outflow, then begin sampling discharges at outflows of each OU or independent treatment train to better define spatial extent of problem. If necessary (i.e., if loading uncertainty is high), increase frequency of surface water collection to monthly (reducing temporal interpolation), or as appropriate for hydraulic retention time (HRT).
- To further define spatial extent of problem, collect multiple mosquitofish composites from within the OU or treatment train exhibiting anomalous conditions.
- If Tier 2 was triggered by tissue levels in large-bodied fish, increase sample size of large-bodied fish to n = 20, i.e., 20 each of sunfish (collect various species and sizes) and/or bass (collect various sizes and extract otolith from bass for age determination).
- To evaluate possible trends in methylation rates in sediments (i.e., to determine if problem is improving or worsening), replicate sediment cores (0-4 cm) can be collected from the suspected methylation "hot spot" and reference locations within the component (for THg, MeHg, moisture content, TOC, TS, and TFe) over a given period of time (i.e., 2 to 4 months). At these same locations and times, collect pore water samples and analyze for THg, MeHg, and sulfides, or if no acceptable pore water protocol has been developed, acid-volatile sulfide (AVS) on solids.

Projects shown to have (spatially) large or multiple MeHg "hotspots" should consider use of the E-MCM or comparable model as an assessment tool (i.e., to synthesize results of expanded monitoring).

Step 2 will also include the notification of the permitting authority that anomalous conditions are continuing. The permitting authority and the permittee may then develop an adaptive management plan using the data generated from the expanded monitoring program. This plan will evaluate the potential risks from continued operation under existing conditions (i.e., through a risk assessment for appropriate ecological receptors). If risk under existing operational conditions is deemed acceptable, then project monitoring would continue under a modified Tier 2 scheme to monitor exposure. On the other hand, if risk under existing operational conditions is deemed unacceptable, then the adaptive management plan would then proceed to determine potential remedial actions to (1) reduce exposure and risk (e.g., signage for human health concerns, reduce fish populations, reduce forage habitat suitability); if risk of acute toxicity - immediate drawdown of OU and reevaluation of ESA [Note that assessment of potential human health impacts and corrective actions (i.e., signage) will require the involvement of the Florida Department of Health]; and (2) affect mercury biogeochemistry to reduce net methylation (e.g., modify hydroperiod or stage, water quality).

In developing this adaptive management plan, the permitting authority may conduct a publicly noticed workshop to solicit comments from the permittee, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Park Service, the Florida Fish and Wildlife Conservation Commission, and other interested persons.

The next step would then be to carry out such remedial or corrective action. If the remedial or corrective action is demonstrated to be successful, then the project would revert back to Phase 2 - Tier 1 monitoring. Alternatively, if monitoring data indicate that the remedial action was unsuccessful in reducing fish tissue concentrations or downstream loading, the permitting authority and the permittee would then initiate a peer-reviewed, scientific assessment of the benefits and risks of the project.

3. Phase 3 - Routine Operational Monitoring (Post-Stabilization)

This section describes assessment measures, action levels and monitoring efforts for the project following the period of stabilization, i.e., during operation in years 4 through 9. Because of differences in the anticipated time frames under which sedimentary release and bioaccumulation are thought to occur, monitoring toxicants other than mercury in water or biological tissues is not a general recommendation past the first year of stabilization.

3.1 Phase 3 - Tier 1: Routine Operational Monitoring

If after the first three years of monitoring neither downstream loading nor residue levels in fishes exceed action levels, then (1) surface water sampling would be discontinued, (2) frequency of mosquitofish collection would be reduced to semiannually, and (3) frequency of large-bodied fish collection reduced to one collection event every three years.

Phase 2 - Tier 2 Monitoring and Risk Assessment during operation is triggered if one of the following action levels is exceeded:

- If annual average THg levels in mosquitofish progressively increased over time (i.e., two or more years) or become elevated to the point of exceeding the 90% upper confidence level of the basin-wide annual average or, if basin-specific data are lacking, exceed the 90^{th} percentile concentration for the period of record for all basins; or
- If triennial monitoring of large-bodied fish (i.e., in years 6 and 9) reveals tissue Hg levels in fishes has statistically increased, progressively over time (i.e., two or more years) or has become elevated to the point of exceeding the 90% upper confidence level of the

basin-wide annual average or, if basin-specific data are lacking, exceeded the 90th percentile concentration for the period of record for all basins.

On the other hand, if fishes collected under Phase 3 Operational Monitoring have not exceeded action levels by year 9, project-specific monitoring would be discontinued; future assessments would be based on regional monitoring under RECOVER. However, Project Managers are cautioned that action levels may be revised at a future date, owing to the likelihood that a tissue-based WQS will be adopted by the state within in next 9 to 10 years.

CONTRACTOR SELECTION CRITERIA

Given the inherent difficulties of ultra-trace monitoring, it is crucial that any contractor selected to carry out field collection has demonstrated prior performance or be trained by District staff and has a stringent quality assurance/quality control (QA/QC) program in place. Likewise, the analytical lab must also demonstrate prior performance in ultra-trace analysis, have a stringent QA/QC program (including inter-laboratory comparisons) and be capable of achieving desired method detection limits.

REPORTING REQUIREMENTS

The District shall submit an annual report to the permitting authority that summarizes the most recent data and compares them with the cumulative results from previous years. This report shall also evaluate assessment performance measures (i.e., action levels) outlined above.

CONTACTS

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A.4 BIOLOGICAL ASSESSMENT

ENDANGERED SPECIES ACT
BIOLOGICAL ASSESSMENT

C-111 Spreader Canal Western Project

Prepared by
Department of the Army
Jacksonville District Corps of Engineers

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A.4.1 EXECUTIVE SUMMARY

The primary restoration purpose for the C-111 Spreader Canal Project is to improve freshwater deliveries and enhance the connectivity and sheetflow in the Model Lands and Southern Glades areas, reduce wet season flows in C-111, and decrease potential flood risk in the lower south Miami-Dade County area. The primary system benefits would include improved hydrologic connectivity in Model Lands and Southern Glades. The secondary system benefits would include improved salinity in the estuarine environment.

The proposed C-111 Spreader Canal Project will be implemented in two phases or increments via Phase I and Phase II Project Implementation Reports (Western PIR and Eastern PIR). The Western PIR represents a value engineered version of Plan Formulation Alternative 2D Short and is intended to improve the quantity, timing, and distribution of water delivered to Eastern Florida Bay via Taylor Slough. The Eastern PIR is intended to hydrate portions of the Southern Glades and Model Lands at shallow depth and low velocity by the construction of a full scale spreader canal and other Eastern PIR features to be studied after the Western PIR is completed.

Species and critical habitat identified during informal consultation as potentially affected by the proposed project include twenty-two federally listed threatened or endangered species; along with designated critical habitat for the American crocodile, Everglade snail kite, West Indian manatee, elkhorn coral, staghorn coral, and the Cape Sable seaside sparrow.

Based on the information contained in this Biological Assessment, the Jacksonville District of the Army Corps of Engineers (USACE) has determined that implementation of the proposed project could establish hydrological changes that would alter some of the physical and biological features within designated critical habitat subpopulations C and D (Units 2 and 3) of the Cape Sable seaside sparrow, resulting in a potential adverse modification to portions of critical habitat within those areas. The overall hydrological modifications also "may affect, and is likely to adversely affect" the sub-species.

Additionally, by including the project commitments and conservation measures described herein, the USACE has determined the project "may affect, but is not likely to adversely affect" the American crocodile, American alligator, West Indian manatee, Florida panther, smalltooth sawfish, wood stork, eastern indigo snake, the Schaus swallowtail butterfly, the green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, the loggerhead sea turtle, the crenulated lead plant, Garber's spurge, and tiny polygala.

Other federally threatened or endangered species that are known to exist or potentially exist within close proximity of the project area, but which will not likely be of concern in this study due to the lack of suitable habitat include, Everglade snail kite, roseate tern, elkhorn coral, and staghorn coral. Potential impacts from project activities to state-listed endangered, threatened, or species of special concern will be minimal and temporary, and not likely to adversely affect any state-protected species.

Recognizing the possibility of re-initiating consultation, the USACE will continue discussions with the U.S. Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS), and the Florida Fish and Wildlife Conservation Commission (FWC) in the event of project design or operational modifications.

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, the USACE is requesting written concurrence from the FWS and the National Oceanic and Atmospheric Administration (NOAA) Fisheries with the determination of this Biological Assessment.

A.4.2 INTRODUCTION

The purpose of a Biological Assessment is to evaluate the potential effects of a federal action (project) on listed and proposed species, including designated and proposed critical habitat, and determine whether the continued existence of any such species or habitat are likely to be adversely affected by the federal action. The Biological Assessment is also used in determining whether formal consultation or a conference is necessary [Federal Register 51 (106): Section 402.1 (f), pg. 19960, 3 June 1986]. This is achieved through the following:

The results of an on-site inspection of the area affected by the federal action to determine if listed or proposed species are present or occur seasonally.

The views of recognized experts on the species at issue.

A review of the literature and other information.

An analysis of the effects of the federal action on species and habitat including consideration of cumulative effects, and the results of any related studies.

An analysis of alternative actions considered by the federal agency for the proposed action.

A.4.3 CONSULTATION SUMMARY

The USACE has consulted with the FWS by letters dated 12 February 2004 and 17 June 2008, on federally listed threatened and endangered species that may be present in the project study area. In a letter dated 14 July 2008, the FWS agreed with the USACE's finding of listed species that may be encountered or adjacent to the project area include the American crocodile (*Crocodylus acutus*), West Indian manatee (*Trichechus manatus*), wood stork (Mycteria americana), Eastern indigo snake (*Drymarchon corais couperi*), the Schaus swallowtail butterfly (*Heraclides areistodemus ponceanus*), the Florida panther (*Puma concolor coryi*), Everglade snail kite (*Rostrhamus sociablis plumbeus*), Cape Sable seaside sparrow (*Ammodramus maritimus*), roseate tern (*Sterna dougallii dougalii*), the crenulated lead-plant (*Amorpha herbacea var. crenulata*), Garber's spurge (*Chamaesyce garberii*), and tiny polygala (*Polygala smallii*). The bald eagle (*Haliaeetus leucocephalus*) has been delisted under the Endangered Species Act but continues to be protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act. On 5 June 2008, project team members of the USACE met with FWS to discuss potential adverse effects to the Cape Sable seaside sparrow and determine a course of action for proper evaluation.

Federally listed species under the purview of the National Marine Fisheries Service include the green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*), and the loggerhead sea turtle (*Caretta caretta*). In addition, the project study area contains designated critical habitat for the American crocodile, Everglade snail kite, West Indian manatee, Cape Sable seaside sparrow, elkhorn coral, and staghorn coral.

A.4.4 PROJECT DESCRIPTION

A.4.4.1 Project Authority

The C-111 Spreader Canal (C-111 SC) project was formulated and authorized as part of the Central and Southern Florida Project Comprehensive Review Study. The Central and Southern Florida Project Comprehensive Review Study, known as the Restudy, was authorized by Section 309 (1) of the Water Resources Development Act (WRDA) of 1992 (Public Laws 102-580). This study was also authorized by two resolutions of the Committee on Transportation and Infrastructure, United States House of Representatives, dated 24 September 1992. Further, Section 528 of the Water Resources Development Act of 1996 provided specific direction and guidance for the Restudy. The Comprehensive Everglades Restoration Plan was authorized by Section 601 of the Water Resources Development Act of 2000 (PL 106-541), as a framework and guide for modifications to the Central and Southern Florida Project to restore the south Florida ecosystem and to provide for the other water-related needs of the region.

A.4.4.2 Description of Proposed Action

The C-111 SC project is a component of the Comprehensive Everglades Restoration Plan (CERP), which was approved by Congress as part of the WRDA 2000 and signed by the President in December 1999. CERP is based on the Central and Southern Florida Project Comprehensive Review Final Study Integrated Feasibility Report and Programmatic Environmental Impact Statement (USACE, 1999). The C-111 SC project is one of 68 CERP projects. The C-111 SC project as defined in CERP is a multi-purpose project that provides for ecosystem restoration of freshwater wetlands, tidal wetlands, nearshore habitat and water quality enhancement.

The primary restoration purpose for the C-111 SC project, as identified in the Restudy is to improve freshwater deliveries and enhance the connectivity and sheetflow in the Model Lands and Southern Glades areas, reduce wet season flows in C-111, and decrease potential flood risk in the lower south Miami-Dade County area. The primary system benefits would include improved hydrologic connectivity in Model Lands and Southern Glades. The secondary system benefits would include improved salinity in the estuarine environment.

The proposed C-111 SC project will be implemented in two phases via the Western and Eastern Project Implementation Reports (PIR). Phase I, or the Western PIR represents a value engineered version of Plan Formulation Alternative 2D and is intended to improve the quality, quantity, timing, and distribution of water delivered to Central Florida Bay and surrounding waters via overland flows through Taylor Slough. The Western PIR would also include the construction of features that were authorized by the 1994 C-111 South Dade GRR and provide a conceptual plan for the remainder of the project to be addressed in Phase II, or the Eastern PIR.

The subsequent Eastern PIR is intended to hydrate portions of the Southern Glades and Model Lands at shallow depth and low velocity by the construction of a full scale spreader canal and other Eastern PIR features to be studied after the Western PIR is completed.

A.4.4.3 Project Objectives

As outlined in the Project Management Plan, the objectives of the C-111 SC project are to:

- Restore the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough to levels nearest as possible to the pre-drainage model runs;
- Improve hydroperiods and hydropatterns in the Southern Glades and Model Lands. The hydroperiods will be improved to optimal levels to support historical vegetation patterns nearest as possible to the pre-drainage model runs; Hydropatterns will be restored to historical sloughs and associated tributaries.
- Return coastal zone salinities in western Florida Bay to levels as close as possible to pre-drainage scenario model runs by restoring upstream water levels in eastern Everglades National Park.

The goal of the C-111 SC Western project is to improve the quantity, timing, and distribution of water delivered to Eastern Florida Bay via Taylor Slough. It is anticipated that these improvements will be realized through the establishment of a hydraulic ridge between Taylor Slough and the C-111 Canal, which will reduce seepage from Taylor Slough, and from its headwaters. The plan is also anticipated to resolve critical project uncertainties related to the ability to reduce seepage losses from Taylor Slough, and resulting flood control responses of the drainage system. Consistent with the National Research Council's principals of Incremental Adaptive Restoration (IAR), information gained from this initial restoration effort will provide valuable information related to the planning of a subsequent phase of the C-111 SC project which involves construction of a spreader canal system to replace the existing C-111 Canal.

The seepage reducing hydraulic ridge will be established by diverting water that is currently being discharged through S-177, S-18C and S-197 into two separate linear infiltration basins to be constructed within South Florida Water Management District (SFWMD) owned lands. Further reductions will be realized by constructing an intermediate water control structure on the lower C-111 Canal, and/or through operational changes at structure S-18C. A network of override stage triggers will be established in order to meet project constraints such as flood-damage reduction, and Endangered Species Act compliance.

A.4.4.4 Project Location

The C-111 Canal is the southernmost canal of the Central and South Florida Flood Control Project and is located in south Miami-Dade County (***Figure A4-1***). The canal serves a basin of approximately 100-square-miles and functions primarily to provide flood protection and drainage for the agricultural areas to the west and south of Homestead, Florida. Southwest of Homestead and Florida City and just south of the agriculturally developed area, C-111 is joined by C-111E and courses south to southeast through extensive marl wetland prairie and coastal mangrove marsh before it ends in Manatee Bay. The C-111 canal and S-18C (located just south of the confluence of C-111E and C-111) were completed in 1966 and the S-197 structure was completed in 1970. S-197 provides a gravity outlet for stormwater runoff during flood conditions and acts as a barrier to prevent saltwater intrusion into the freshwater wetlands of the Southern Glades Wildlife and Environmental Area (SGWEA) located to the north of the Everglades National Park's (ENP) eastern panhandle. The C-111 Canal is also the final segment of the South Dade Conveyance System for maintaining water supply and flood protection. The C-111 Canal also provides a means to deliver water to ENP's Taylor Slough and the eastern panhandle area to meet the minimum water delivery schedule, under Federal Statute (P.L. 91-282).

A.4.4.5 Recommended Plan Elements

The C-111 SC Western Project Recommended Plan is Alternative 2DS and includes the following features:

Frog Pond Detention Area
Aerojet Canal
One New Operable Structure in the Lower C-111 Canal
Incremental Operational Changes at S-18C
One Plug at S-20A
Operational Changes at Existing Structure S-20
Ten Plugs in the C-110 Canal

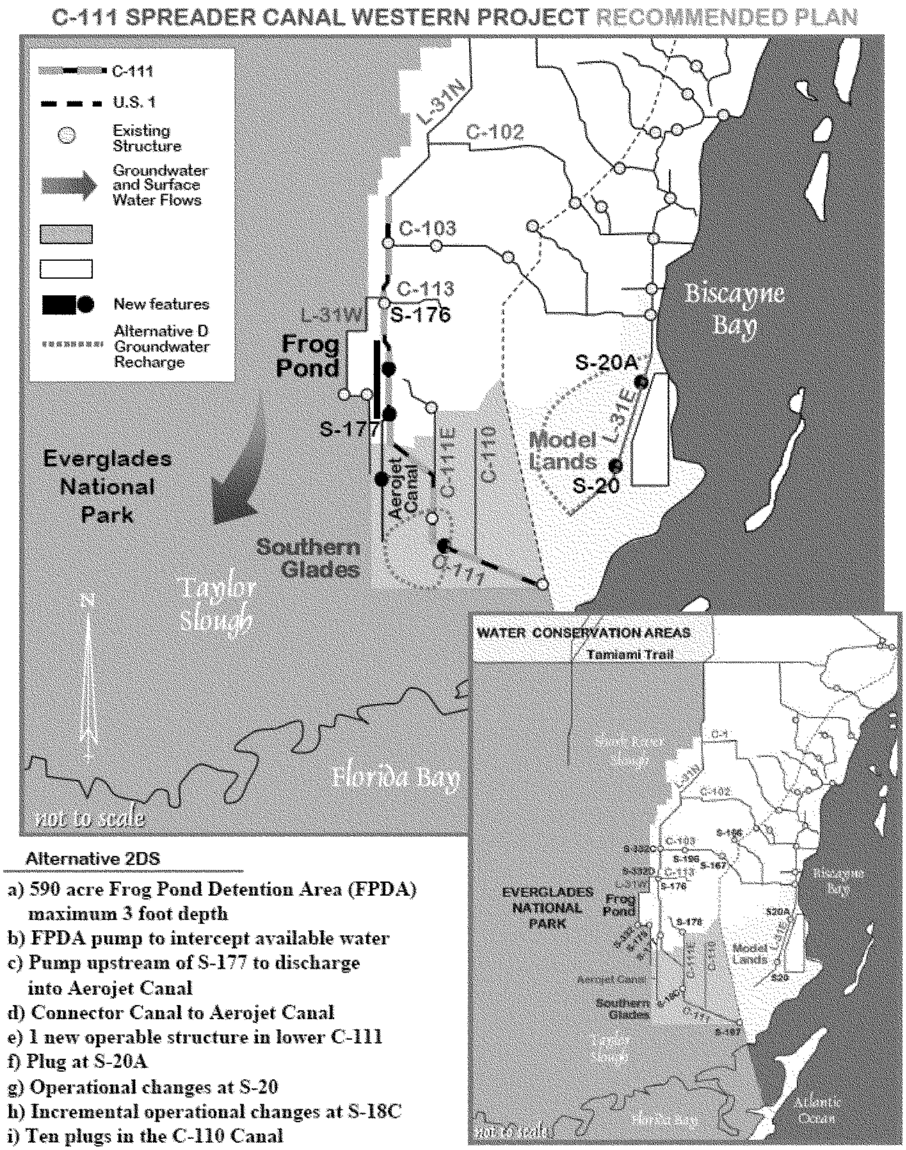

FIGURE A4-1: C-111 SPREADER CANAL WESTERN PROJECT IMPLEMENTATION REPORT: RECOMMENDED PLAN

A.4.4.5.1 Frog Pond Detention Area

As currently envisioned, water that otherwise would be discharged via S-177 is routed to the proposed above ground, 590 acre Frog Pond Detention Area (FPDA) via a proposed S-200 pump station (225 cfs) to be constructed downstream of S-176. The FPDA is designed to meet the requirements of a Low Hazard Potential Facility. The perimeter containment levee has an elevation of +9.0 feet NAVD88. The average height above existing ground elevation is about 5.5 feet. The S-200 pump station, which will trigger at stages slightly lower than S-177's current open criteria [Interim Operational Plan (IOP)] will discharge to a concrete-lined, aboveground, conveyance channel, that discharges to an aboveground, cascading header channel located along the western side of the proposed aboveground FPDA.

The cascading header channel will assist in prevention of seepage losses from Taylor Slough and will ensure that available water is staged higher prior to discharge into one of three individual cells within FPDA. Cascading water levels will be maintained by constructing two 80-foot long east-west weirs at 1/3 points along the length of the header canal. The weir crest elevations are set to be 0.5 ft above existing ground elevation.

Just upstream of the two header weirs and just upstream of the southern levee of the southern detention area cell, 80-foot long north-south weirs will be constructed between the header canal and FPDA cells. The weirs crest elevations are set to be 1.2 ft above existing ground elevation. Pumping will also cease if ponding within Cape Sable seaside sparrow (CSSS) subpopulation C reaches a depth of ten centimeters, as measured at a pre-determined representative location.

Note: Planning level design of the FPDA was established at 530 acres for alternative comparison purposes. The size of the FPDA has increased to 590 acres after preliminary detailed modeling and design.

A.4.4.5.2 Aerojet Canal

Similar to the FPDA, water that otherwise would be discharged via S-177 is routed to the Aerojet Road Canal that is proposed to be extended several thousand feet to the north. The northern limit of the existing Aerojet Canal presently lies approximately one mile south of Ingraham Highway. Although plugged at various locations, its overall length currently extends a distance of approximatley 4.6 miles. It is proposed to effectively extend the northern limit of the canal to a point approximately 2,300 feet south of State Road (SR) 9336 as an unlined above ground open channel, to construct a concrete-lined above ground channel between the northern canal extension and S-199, construct perimeter grading around all unlined portions of the canal north of the east-west borrow canal, construct a new earthern weir with crest elevation 1.0 foot below adjacent natural ground, and convert all existing plugs over that same length to similar weirs. A second, S-199 pump station (225 cfs), will have the same triggers as S-200 and will be constructed immediately upstream of S-177 (downstream of State Road 9336). S-199 will discharge into a concrete-lined, aboveground channel which will be constructed parallel to (south of) SR 9336. The conveyance channel will, in turn, discharge to an above ground, unlined, northern extension of the Aerojet Canal.

The intent of the Aerojet Road Canal features is to extend the hydraulic ridge created by the FPDA south of SR 9336, thus reducing Taylor Slough seepage from what is reportedly the leakiest section of the C-111 Canal system. The reduction of seepage losses keeps water within the natural system, increasing project benefits. Similar to the FPDA header canal, cascading water levels will be maintained within the Aerojet Road Canal by converting 3 existing earthen plugs to broad crested weirs and construction of a new broad crested weir. The crest elevations will be 1 foot below adjacent existing grades, and the canal will include sufficient freeboard to prevent levee bank from being overtopped. Pumping will also cease if ponding within CSSS subpopulation D reaches a depth of ten centimeters, as measured at a pre-determined representative location.

A.4.4.5.3 Secondary Water Control Features

A.4.4.5.3.1 One Operable Structure in the Lower C-111 Canal

The plan also includes the construction of an operable structure within the lower C-111 Canal. The proposed structure is intended to create groundwater mounding, thereby reducing current levels of seepage from the lower C-111 Canal while preserving existing levels of flood damage reduction.

A.4.4.5.3.2 Incremental Operational Changes at S-18C

In order to maximize restoration opportunities, the plan includes incremental operational changes in the current “open and close” triggers at existing structure S-18C. The “open and close” triggers will be increased in increments of no more than 0.1-feet per year and the total change in either trigger shall not exceed 0.4-feet. Stage override triggers will be established immediately downstream of S-177 and/or in the adjacent agricultural lands to establish a “backstop” at which S-18C triggers will return to their existing levels. The incremental operational changes at S-18C will serve to supplement groundwater mounding in the lower C-111 area.

A.4.4.5.3.3 Plug at S-20A and Operational Changes at S-20

In order to maximize restoration opportunities, the plan includes incremental operational changes in the current "open and close" triggers at existing structure S-18C. The "open and close" triggers will be increased in increments of no more than 0.1-feet per year and the total change in either trigger shall not exceed 0.4-feet. Stage override triggers will be established immediately downstream of S-177 and/or in the adjacent agricultural lands to establish a "backstop" at which S-18C triggers will return to their existing levels. The incremental operational changes at S-18C will serve to supplement groundwater mounding in the lower C-111 area.

A.4.4.5.3.4 C-110 Canal Plugs

Finally, the plan includes construction of earthen plugs at key locations within the C-110 Canal in order to promote sheet flow within the Southern Glades. As currently envisioned, ten plugs will be constructed at semi-regular intervals by returning the existing spoil material from the canal banks to the Canal. Any remaining spoil not utilized in construction of the plugs will be placed into the canal to further promote sheetflow and to lessen the effects of the of any remaining canal segments.

A.4.5 DESCRIPTION OF LISTED SPECIES AND DESIGNATED CRITICAL HABITAT

A.4.5.1 Affected Environment

The project area includes lands west of L-31W referred to as Taylor Slough; the northeast corner of ENP known as the panhandle; extending south to the estuaries of northeast Florida Bay. The project area also extends east of L-31W within the South Dade Wetlands (SDW), southeast of the Miami Rock Ridge. The SDWs form a contiguous habitat corridor with ENP, Biscayne National Park (BNP), Crocodile Lakes National Wildlife Refuge, the north Key Largo conservation and recreational lands purchases, the North Key Largo Hammocks Botanical Park, John Pennekamp State Park and the existing National Marine Sanctuary. The SDW is divided into the Model Lands and the Southern Glades, and is isolated from direct surface water flows from the Everglades by a series of roads and flood-control canals. Approximately 80 percent of the land in the SDW has not been directly disturbed for human use; disturbance has generally been limited to changes in hydrology. Where physical disturbance has occurred, the most frequent cause is agriculture. Essentially all of the farming activities within the management area have ceased. Previously farmed lands have revegetated, in some cases with invasive exotic species. Extreme hydroperiod events have changed the structure and function of this once hydrologically connected basin. Over-drainage has shortened hydroperiods in the marshes adjacent to C-111. This change has displaced the historic function of the lower basin wetlands and has provided recruitment opportunities for exotic plants and animals.

The western portion of the Model Lands is made up of the wetlands in the north C-111 Basin, located adjacent to the C-111, east of ENP, west of U.S. Highway 1, north of SW 424th Street and south of State Road 9336, with the exception of active agricultural land. The eastern portion includes the wetlands south of SW 344th Street (Palm Drive), east of U.S. Highway 1, and South to Biscayne Bay, Card Sound, and Barnes Sound.

The Southern Glades region is bounded by ENP to the south and west, U.S. Highway 1 to the east and the Model Lands to the north except for the far western edge, west of C-111E, which extends further north to the boundary of the Frog Pond. The SFWMD owns most of the property within this area.

The SDW is located in the extreme southeastern lobe of the Everglades system. The land is low-lying and very flat, with natural elevations generally less than one meter above sea level. The soils are predominantly marls, mixed with and grading into peat soils near the coastline. Undeveloped areas contain predominantly wetland vegetation, plus disturbed, rural upland areas with roads, levees and other man-made features. The region supports a variety of wetland dependent wildlife, including several state and federally-listed endangered and threatened wildlife species.

As a consequence of past and current water management practices, land development and sea level rise, freshwater wetlands in the project area have been reduced in a real extent, altered and degraded. Currently much of this area is drained. Water elevations are generally held close to or below land surface in the northern project area, or starved of water as in the Model Lands area where water is diverted by drainage structures toward other basins. The current operation of the systems has resulted in an inland migration of saline conditions in both the groundwater and surface waters such that the expansion of moderate to high salinity zones have diminished the spatial extent of freshwater wetland habitats, and have allowed the landward expansion of saltwater and mangrove wetlands, including low-productivity, sparsely vegetated dwarf mangroves communities typical of the hypersaline "white zone." Some wetlands have been impacted by invasive exotic vegetation as a result of physical disturbance and/or hydrologic isolation.

A.4.5.1.1 Vegetative Communities

The primary factors influencing the distribution of vegetation in this region are hydropattern, salinity, previous disturbance, and to a lesser extent, nutrient loading and soil type. The C-111 Spreader Canal, including both the Western and Eastern project areas, is divided into five ecological/vegetation zones (***FIGURE A4-2***). Ecological Zone 1 is considered to be the mostly developed area north of the Model Lands and Southern Glades, consisting of residential and agricultural areas, and the business communities of Florida City and Homestead; within this zone, certain tracts have been purchased by Miami-Dade County for conservation or recreation or those preserved as buffer lands for the Florida Keys Aqueduct Authority. Ecological Zone 2 is a shrub-dominated freshwater marsh. At this highest elevation, the sawgrass prairie alternates with forested wetlands. Ecological Zones 3 and 4 are various sawgrass communities, showing the transition from more freshwater to higher salinity water. The dominant vegetation community in the region is a matrix of sawgrass prairie with tree islands (Ecological Zone 3). The tree islands vary in vegetation composition, depending upon elevation. Some tree islands in Ecological Zone 4 have freshwater species in the interior section, and are ringed with mangrove or salt-tolerant species. At the lowest elevations near the coast mangroves replace the freshwater wetlands. The transition zone between the mangroves and the freshwater prairie is a needle rush-salt grass zone on the freshwater side, but stunted scrub mangrove on the coastal side. Zone 5 is the hypersaline "white zone," notable due to its appearance on remotely-sensed images as a white band, and sparse vegetation with stunted mangroves. Recent (2000) studies in this area indicate that the inner boundary of the white zone has moved inland by an average of one and a half kilometers since 1940 and the zone is expanding. The most significant changes have occurred on the Biscayne Bay side of U.S. Highway 1. The low productivity of the white zone may be primarily due to wide seasonal fluctuations in salinity and moisture content and the absence of freshwater input form upstream sources. ***TABLE A4-1*** lists the plants commonly found in any particular ecological zones.

The plant community can strongly influence wildlife composition and patterns of utilization. The plant community types present in the SDW Management Area (SDWMA) include sawgrass glades, spike rush and beak rush flats, muhly prairie, cypress stands, native dominated forested wetlands, tree islands, mangrove flats, hydric hammocks, and exotic-dominated forests. Natural disturbances, such as fire, play an important role in maintaining a diverse mosaic of vegetation communities. Altered hydroperiods, wildfire suppression and human caused fires have disrupted the natural frequency and pattern of fires in the region.

Invasive species present in the SDWMA include melaleuca (*Melaleuca quinquenervia*), Australian pine (*Casuarina* spp.), and Brazilian pepper (*Schinus terebinthifolius*), among others. The heaviest impacts from invasive species tend to occur in disturbed areas within the SDWMA, such as abandoned farmland and lands in the immediate vicinity of roads and berms. Such areas are frequently dominated by nearly monotypic stands of invasive plants. Elsewhere, these invasive plants are present in smaller, but no less important numbers in tree islands, marshes, and mangrove forests as a result of long distance seed dispersal. In other regions of the county, such outlier populations have rapidly expanded to create additional problems when left untreated.

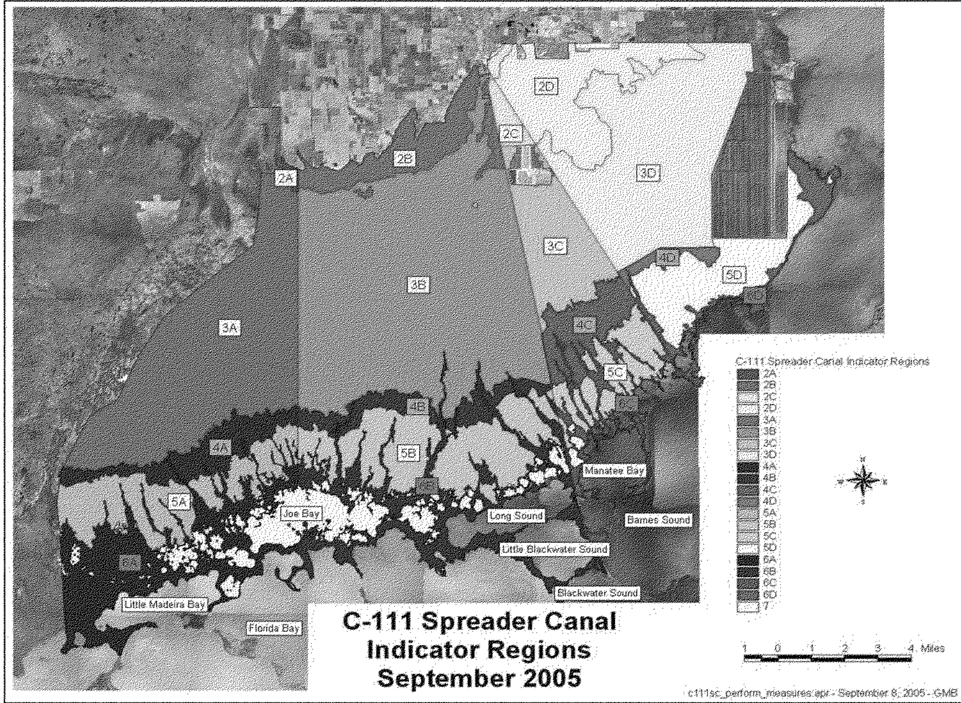

FIGURE A4-2: ECOLOGICAL/VEGETATIVE ZONES WITHIN PROJECT AREA

TABLE A4-1: COMMON VEGETATION WITHIN ECOLOGICAL ZONES

Zone	Landscape	Common Plants Found in Zones
2	Shrub dominated forested wetland	Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina* spp.), dahoon holly (*Ilex cassine*), swamp bay (*Persea palustris*), sweet bay (*Magnolia virginiana*), willow (*Salix caroliniana*), and sawgrass (*Cladium jamaicense*)
3	Sawgrass	Sawgrass, muhly grass (*Muhlenbergia capillaris*), swamp bay, dahoon holly, wax myrtle (*Myrica cerifera*), willow, and cocoplum (*Chrysobalanus icaco*), sweet bay, myrsine (*Rapanea guianensis*), bald cypress (*Taxodium distichum*), and pond apple *(Annona glabra*)
4	Mixed graminoid with mangroves	Sawgrass, swamp bay, dahoon holly, wax myrtle, cocoplum, myrsine, poisonwood (*Metopium toxiferum*), buttonwood (*Conocarpus erectus*), red mangrove (*Rhizophora mangle*), stoppers (*Eugenia* spp.), spicewood (*Calyptranthes pallens*), and cocoplum
5	White zone ecotone	Dwarf red mangroves, sparse graminoids
6	Coastal forest	Red mangrove, white mangrove (*Laguncularia racemosa*), Brazilian pepper , Australian pine, wax myrtle,, poisonwood,, buttonwood, spicewood, myrsine, stoppers, white indigo berry (*Randia aculeata*)

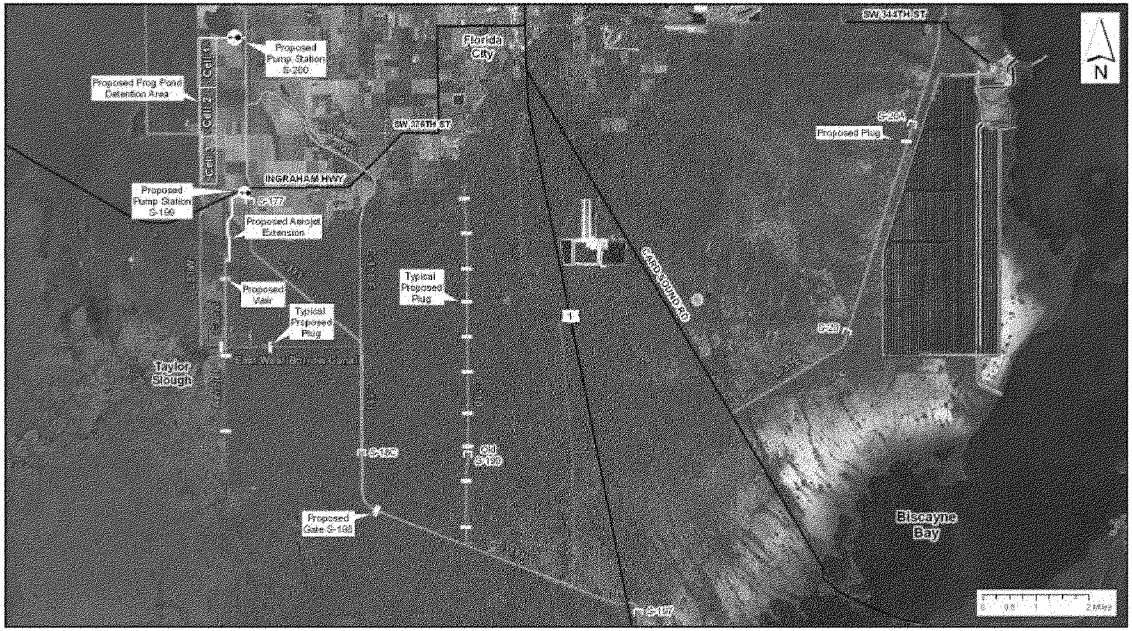

FIGURE A4-3: C-111 SPREADER CANAL PROJECT AREA WITH PROPOSED FEATURES

A.4.5.2 Federally Listed Species

The USACE has coordinated the existence of federally listed species with the FWS and with NOAA Fisheries, as appropriate. Specifically, coordination with NOAA Fisheries includes listed fish, marine plants, and sea turtles at sea. Coordination with the FWS includes other listed plants and animals (FWS, 2008). Twenty-two federally listed threatened and endangered species are either known to exist or potentially exist within the project area and, subsequently, may be affected by the proposed action (***TABLE A4-2***). Many of these species have been previously affected by habitat impacts resulting from wetland drainage, alteration of hydroperiod, wildfire, and water quality degradation.

Federally listed animal species include the American crocodile (*Crocodylus acutus*), American alligator (*Alligator mississippiensis*), West Indian manatee (*Trichechus manatus*), Florida panther (*Puma concolor coryi*), smalltooth sawfish (*Pristia pectinata*), Cape Sable seaside sparrow (*Ammodramus maritimus*), wood stork (*Mycteria Americana*), eastern indigo snake (*Drymarchon corais couperi*), and the Schaus swallowtail butterfly (*Heraclides areistodemus ponceanus*). Five federally listed sea turtles species also exist or potentially exist in the project area, including the green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), and the loggerhead sea turtle (*Caretta caretta*). Other federally threatened or endangered animal species that are known to exist or potentially exist in Miami-Dade County, but which will likely not be of concern in this study due to the lack of suitable habitat in and within close proximity of the project area include, Everglade snail kite (*Rostrhamus sociablis plumbeus*), roseate tern (*Sterna dougallii dougalii*) and the elkhorn (*Acropora palmata*), and staghorn (*Acropora cervicornis*) stony corals.

Federally listed plant species that may occur in the project area include the crenulated lead plant (*Amorpha herbacea var. crenulata*), Garber's spurge (*Chamaesyce garberii*), and the tiny polygala (*Polygala smallii*). Most of these plant species are associated with pine rocklands, which only occur at the northern extreme of the project area and are highly unlikely to be affected by the project. A number of candidate plant species are known to exist or potentially exist in the project area, most of which are also associated with pine rocklands (FWS, 2004).

A.4.5.3 State Listed Species

The project area also provides habitat for several state listed species. State listed endangered species include the arctic peregrine falcon (*Falco peregrinus tundrius*), the Florida mastiff bat (*Eumops glaucinus floridanus*), the bracted colic root (*Aletris bracteata*), Eaton's spikemoss (*Selaginella eatonii*), Wright's flowering fern (*Anemia wrightii*), the Mexican vanilla plant (*Vanilla Mexicana*), and the Schizaea tropical fern (*Schizaea pennula*). Threatened species include the white-crowned pigeon (*Columba leucocephalus*), least tern (Sterna antillarum), piping plover (*Charadrius melodus*), Miami black-headed snake (*Tantilla olitica*), the Everglades mink (*Mustela vison evergladensis*), and the pine-pink orchid (*Bletia purpurea*). State-listed species of special concern include the roseate spoonbill (*Ajaia ajaia*), limpkin (*Aramus guarauna*), little blue heron (*Egretta caerulea*), reddish egret (*E. rufescens*), snowy egret (*E. thula*), tricolored heron (*E. tricolor*), white ibis (*Eudocimus albus*), brown pelican (*Pelecanus occidentalis*), black skimmer (*Rynchops niger*), mangrove rivulus (*Rivulus marmoratus*), gopher tortoise (*Gopherus polyphemus*), American alligator (*Alligator mississippiensis*), and the Florida tree snail (*Liguus fasciatus*).

TABLE A4-2: STATUS OF THREATENED & ENDANGERED SPECIES LIKELY TO BE AFFECTED BY PHASE 1 OF THE C-111 SC PROJECT - AND THE USACE'S EFFECT DETERMINATION

Common Name	Scientific Name	Status	Agency	May Affect, Likely to Adversely Effect	May Affect, Not Likely to Adversely Effect	No Effect
Mammals						
West Indian manatee*	*Trichechus manatus*	E	Federal		X	
Florida panther	*Puma concolor coryi*	E	Federal		X	
Everglades mink	*Mustela vison evergladensis*	T	State			X
Florida mastiff bat	*Eumops glaucinus floridanus*	E	State			X
Birds						
Cape Sable seaside sparrow	*Amodramus maritimus mirabilis*	E	Federal	X		
Wood stork	*Mycteria americana*	E	Federal		X	
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E	Federal			X
Roseate tern	*Sterna dougallii dougallii*	T	Federal			X
Arctic peregrine falcon	*Falco peregrinus tundrius*	E	State			X
White-crowned pigeon	*Columba leucocephalus*	T	State			X
Least tern	*Sterna antillarum*	T	State			X
Piping plover	*Charadrius melodus*	T	State			X
Limpkin	*Aramus guarauna*	SC	State			X
Little blue heron	*Egretta caerulea*	SC	State			X
Tricolored heron	*Egretta tricolor*	SC	State			X
Snowy egret	*Egretta thula*	SC	State			X
Reddish egret	*Egretta rufescens*	SC	State			X
White ibis	*Eudocimus albus*	SC	State			X
Roseate spoonbill	*Ajaja ajaja*	SC	State			X
Brown pelican	*Pelecanus occidentalis*	SC	State			X
Black skimmer	*Rynchops niger*	SC	State			X
Reptiles						
American crocodile*	*Crocodylus acutus*	T	Federal		X	
American alligator	*Alligator mississippiensis*	T/SA	Federal		X	
Eastern indigo snake	*Drymarchon corais couperi*	T	Federal		X	
Miami black-headed snake	*Tantilla oolitica*	T	State			X
Gopher tortoise	*Gopherus polyphemus*	SC	State			X
Green sea turtle	*Chelonia mydas*	E	Federal		X	
Leatherback sea turtle	*Dermochelys coriacea*	E	Federal		X	
Hawksbill sea turtle	*Eretmochelys imbricata*	E	Federal		X	

Loggerhead sea turtle	*Caretta caretta*	T	Federal		X	
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	Federal		X	
Fish						
Mangrove rivulus	*Rivulus marmoratus*	SC	State		X	
Smalltooth sawfish	*Pristia pectinata*	E	Federal		X	
Invertebrates						
Elkhorn coral	*Acropora palmata*	T	Federal			X
Staghorn coral	*Acropora cervicornis*	T	Federal			X
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E	Federal		X	
Florida tree snail	*Liguus fasciatus*	SC	State			X
Plants						
Tiny polygala	*Polygala smallii*	E	Federal		X	
Crenulated lead plant	*Amorpha crenulata*	E	Federal		X	
Garber's spurge	*Chamaesycegarberi*	T	Federal		X	
Bracted colic root	*Aletris bracteata*	E	State			X
Pine-pink orchid	*Bletia purpurea*	T	State			X
Lattace vein fern	*Thelypteris reticulate*	E	State		X	
Eatons spikemoss	*Selaginella eatonii*	E	State		X	
Wright's flowering fern	*Anemia wrightii*	E	State		X	
Tropical fern	*Schizaea pennula*	E	State		X	
Mexican vanilla	*Manilla mexicana*	E	State		X	

* Critical habitat designated for this species
E: Endangered
T: Threatened
SC: Species of Special Concern
SA: Similarity of Appearance species

A.4.5.4 Designated Critical Habitat

In addition to threatened and endangered species, the project area also includes or is adjacent to designated critical habitats for the American crocodile, the Everglade snail kite, the West Indian manatee, the Cape Sable seaside sparrow, Johnson's seagrass, elkhorn coral, and staghorn coral. Maps of critical habitat locations for these species are depicted in ***FIGURE A4-4*** to ***FIGURE A4-8***.

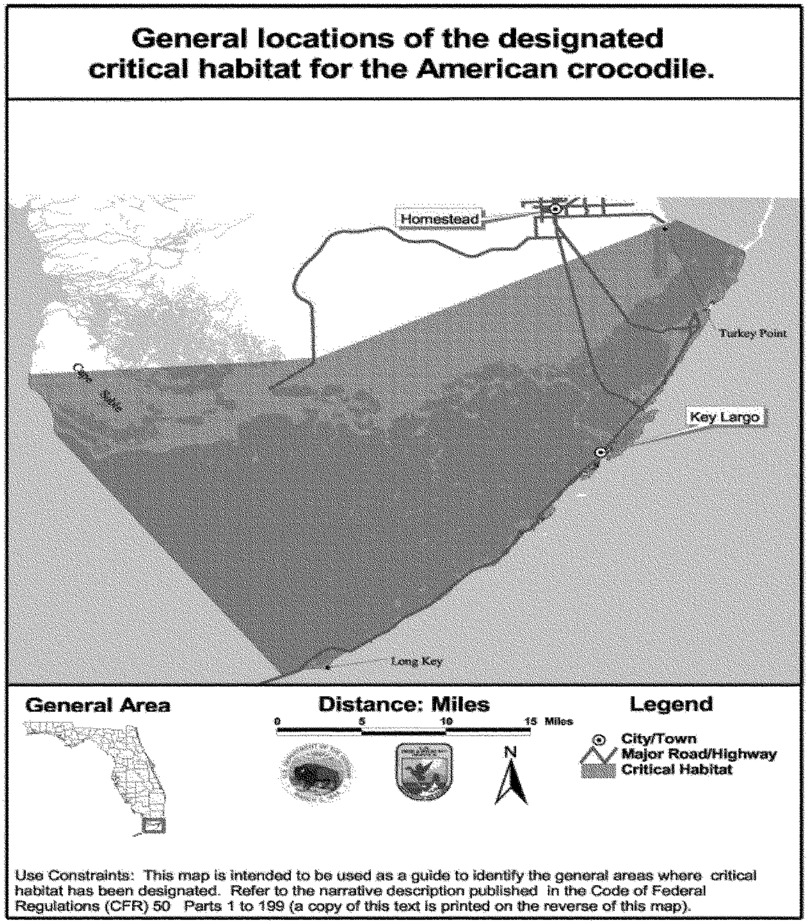

FIGURE A4-4: CRITICAL HABITAT FOR THE AMERICAN CROCODILE

As defined in the Code of Federal Regulations (50 parts 1 to 199; 1 October 2000), the American crocodile's critical habitat includes all land and water within the following boundary: Beginning at the easternmost tip of Turkey Point, Dade County, on the coast of Biscayne Bay; then southeastward along a straight line to Christmas Point at the southernmost tip of Elliott Key; then southwestward along a line following the shores of the Atlantic Ocean side of Old Rhodes Key, Palo Alto Key, Anglefish Key, Key Largo, Plantation Key, Windley Key, Upper Matecumbe Key, Lower Matecumbe Key, and Long Key; then to the westernmost tip of Middle Cape; then northward along the shore of the Gulf of

Mexico to the north side of the mouth of Little Sable Creek; then eastward along a straight line to the northernmost point of Nine-Mile Pond; then northeastward along a straight line to the point of beginning.

Specific to this project, the crocodile's critical habitat starts at the easternmost tip of Turkey Point and continues southeast and southwest across the northern part of the C-111 SC Project area. The Model Lands, including the wedge area between U.S. Highway 1 and Card Sound Road, lie within critical habitat for this species (50 CFR; 10-01-00).

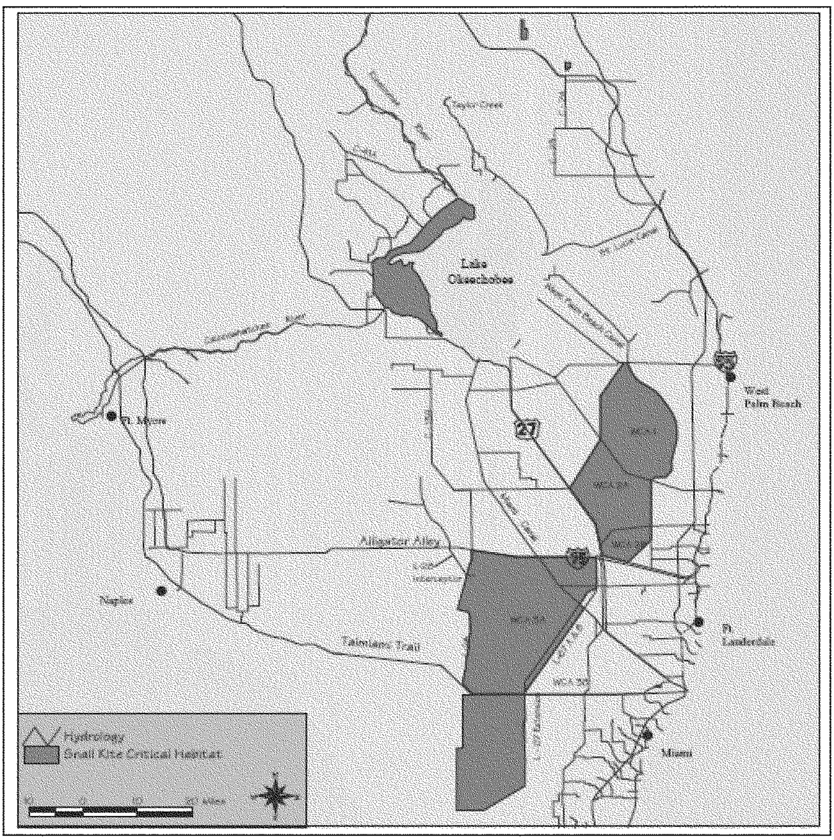

FIGURE A4-5: CRITICAL HABITAT FOR THE EVERGLADE SNAIL KITE

Although previously located in freshwater marshes over considerable areas of peninsular Florida, the range of the Everglade snail kite is currently more limited. This bird is now restricted to several impoundments on the headwaters of the St. John's River; the southwest side of Lake Okeechobee; the eastern and southern portions of Water Conservation Areas (WCA) 1, 2A and 3; the southern portion of WCA 2B; the western edge of WCA 3B; and the northern portion of Everglades National Park (FWS, May 1996).

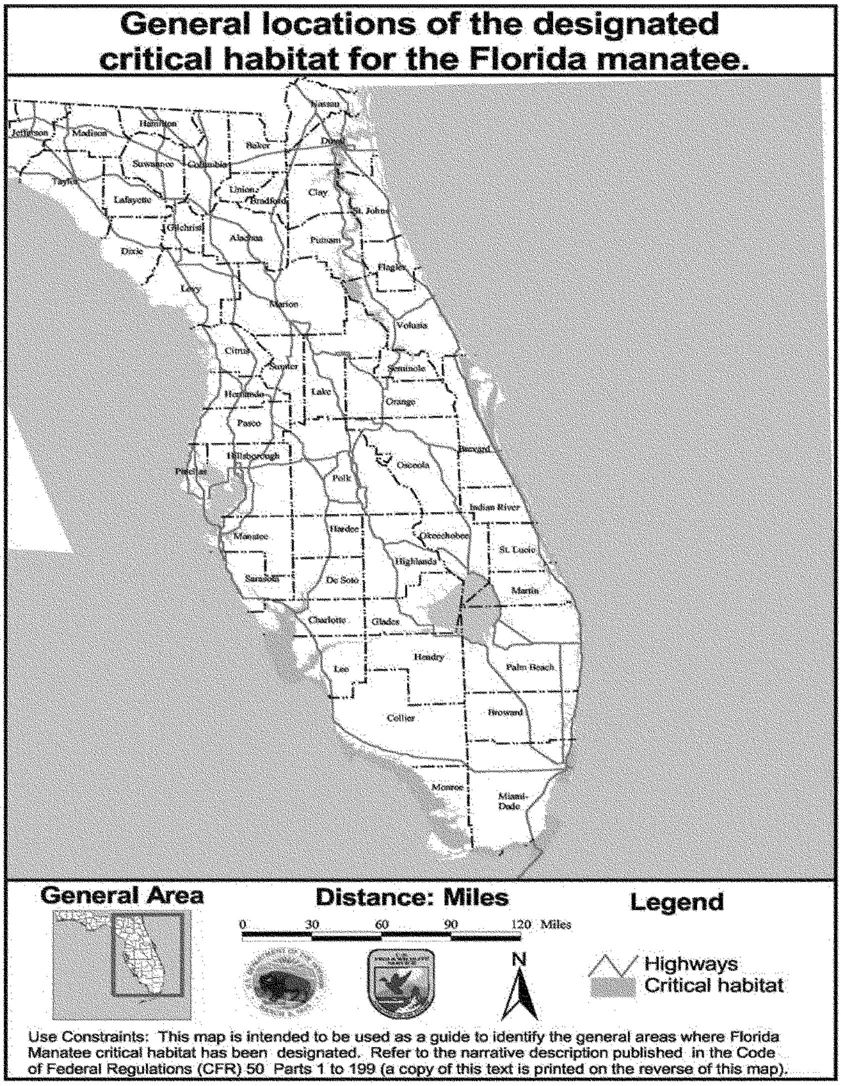

FIGURE A4-6: CRITICAL HABITAT FOR THE WEST INDIAN MANATEE

The West Indian manatee's critical habitat includes all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee and Buttonwood sounds between Key Largo, Monroe County, and the mainland of Miami-Dade County. Card and Barnes sounds are in the southern part of the Eastern PIR portion of the project area. The northern part of the Western PIR portion of the project area lies close to another segment of designated critical habitat for the West Indian manatee. This component is defined as "Biscayne Bay, and all adjoining and connected lakes, rivers, canals and waterways from the southern tip of Key Biscayne northward to and including Maule Lake, Dade County." (CFR 50 Parts 1 to 199; 10-01-00).

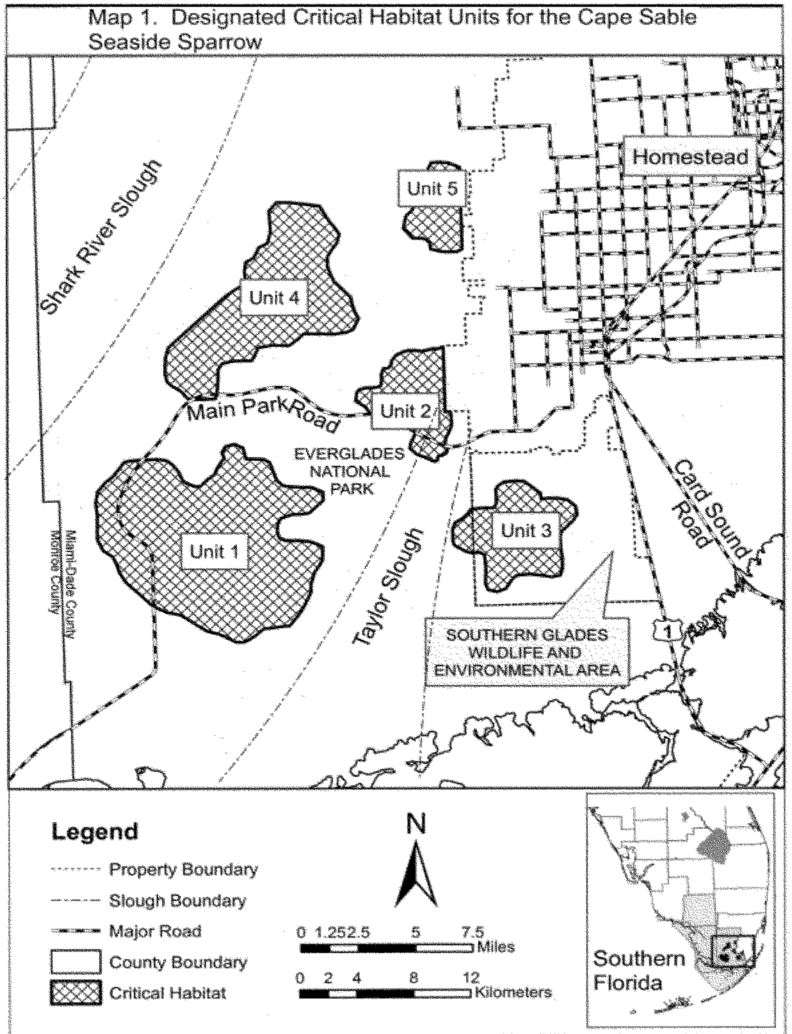

FIGURE A4-7: CRITICAL HABITAT FOR THE CAPE SABLE SEASIDE SPARROW

Designated critical habitat for the Cape Sable seaside sparrow include areas of land, water, and airspace in the Taylor Slough vicinity of Collier, Dade, and Monroe Counties, with the following components: those portions of Everglades National Park within T57S R36E, T57S R36E, T57S R37E, T58S R35E, T58S

R36E, T58S R37E, T58S R35E, T58S R36E, T59S R35E, T59S R36E, T59S R37E. Areas outside of Everglades National Park within T55S R37E Sec. 36; T55S R38E Sec. 31, 32; T56S R37E Sec. 1, 2, 11-14, 23-26; T56S R38E Sec. 5-7, 18, 19; T57S R37E Sec. 5-8; T58S R38E Sec. 27, 29-32; T59S R38E Sec. 4 (CFR Vol. 72, No. 214 / 11-6-07)

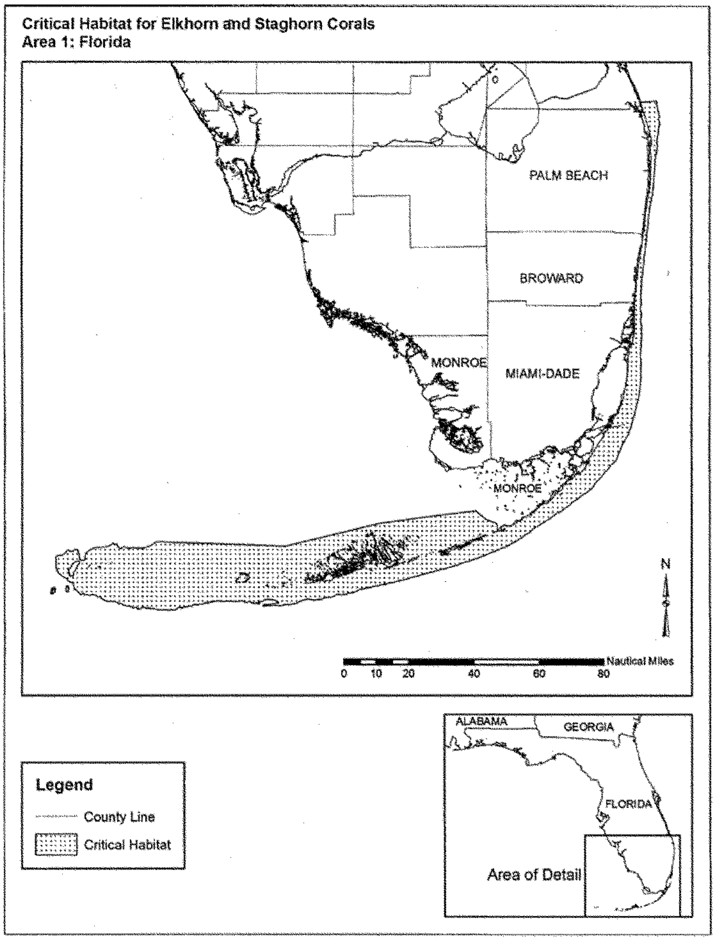

FIGURE A4-8: CRITICAL HABITAT FOR ELKHORN AND STAGHORN CORALS

In Southeast Florida, staghorn coral has been documented along the east coast as far north as Palm Beach County in deeper (16 to 30 m) water and is distributed south and west throughout the coral and hardbottom habitats of the Florida Keys, through Tortugas Bank. Elkhorn coral has been reported as far north as Broward and Miami-Dade Counties, with significant reef development and framework construction by this species beginning at Ball Buoy Reef in Biscayne National Park, extending discontinuously southward to the Dry Tortugas (CFR Vol. 73, No. 25, 02-06-08).

A.4.6 EFFECTS OF PROPOSED ACTION

A.4.6.1 Species Biology and Effect Determination

A.4.6.1.1 "No Effect" Determination

Federally threatened or endangered species that are known to potentially exist within close proximity of the project area, but which will not likely be of concern are discussed in detail below:

A.4.6.1.1.1 The Everglade Snail Kite and "No Effect" Determination

The snail kite inhabits relatively open freshwater marshes, which support adequate populations of apple snail, upon which this bird feeds almost exclusively. Favorable areas consist of extensive shallow, open water such as sloughs and flats, vegetated by sawgrass and spikerush (*Eleocharis* spp). The areas are often interspersed with tree islands or small groups of scattered shrubs and trees which serve as perching and nesting sites. The water level must be sufficiently stable to prevent loss of the food supply through drying out of the surface.

The snail kite is threatened primarily by habitat loss and destruction. Widespread drainage has permanently lowered the water table in some areas. This drainage permitted development in areas that were once kite habitat. In addition to loss of habitat through drainage, large areas of marsh are heavily infested with water hyacinth, which inhibits the kite's ability to see its prey (FWS, May 1996).

Snail kites are seen along the south east reach of the C-111 adjacent to the Southern Glades. It is likely that they feed in the area when water levels are high enough. Although some snail kite foraging occurs in the project area, the utilization of project waters for a food base is minimal in the southern part of the project area due to tidal influence resulting in brackish to hyper-saline conditions which are typically unsuitable for their main food source, the apple snail. Sawgrass and tree island habitats are present in the northern part of the project and these areas could be suitable for snail kite foraging. Successful project implementation is expected to provide hydration necessary to sustain these habitats. For areas near the southern end of the Everglades system, project restoration could provide important refugia to this species. Because of the potential for habitat improvement for the species and its primary food source; the USACE has determined the proposed project will have no adverse effect on the Everglade snail kite.

A.4.6.1.1.2 Everglade Snail Kite Critical Habitat

Additionally, the project will have no adverse effect on critical habitat for the Everglade snail kite.

A.4.6.1.1.3 Roseate Tern and "No Effect" Determination

A coastal species, the roseate tern nests on open sandy beaches away from potential predation and human disturbance. This species feeds in nearshore surf on small schooling fishes. In southern Florida, the roseate tern's main nesting areas are located in the Florida Keys and the Dry Tortugas where they nest on isolated islands, rubble islets, and dredge spoils. Although suitable foraging opportunities exist along the shoreline within the project area, the proposed project is not likely to adversely affect their feeding habits or nesting areas. Therefore, the USACE has determined the project will have no effect on the roseate tern.

A.4.6.1.1.4 Elkhorn Coral and "No Effect" Determination

Elkhorn coral is a large, branching coral with thick and sturdy antler-like branches. The dominant mode of reproduction is asexual, with new colonies forming when branches break off of a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites). Colonies are fast growing: branches increase in length by two to four inches (five to ten centimeters) per year, with colonies reaching their maximum size in approximately ten to 12 years. Elkhorn coral was formerly the dominant species in shallow water (three to 16 feet [one to five meters] deep) throughout the Caribbean and on the Florida Reef Tract, forming extensive, densely aggregated thickets in areas of heavy surf. Coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 feet (six meters), although isolated corals may occur to 65 feet (20 meters). Elkhorn coral is found on coral reefs in southern Florida, the Bahamas, and throughout the Caribbean. Its northern limit is Broward County, off Pompano Beach, and it extends south to Venezuela. Since 1980, populations have collapsed throughout their range from disease outbreaks with losses compounded locally by hurricanes, increased predation, bleaching, elevated temperatures and other factors.

Elkhorn coral may be found outside the waters of Florida Bay, specifically within the offshore reef track of the Florida Keys where salinities are stable (35 parts per thousand) and more representative of open ocean conditions. The reef tract is approximately ten to 20 miles seaward of the shoreline. Anticipated salinity alterations resulting from project activities are not expected to occur beyond 1500 meters from shore. Because the reef tract where elkhorn coral resides is several miles outside of any projected salinity changes, the USACE has determined the proposed project would have no effect on elkhorn coral.

A.4.6.1.1.5 Elkhorn Coral Critical Habitat

Salinities, due to project operations, will not be altered in the vicinity of critical habitat; therefore, the project would have no effect on critical habitat for elkhorn coral.

A.4.6.1.2 Staghorn Coral and "No Effect" Determination

Staghorn coral is a branching coral with cylindrical branches ranging from a few centimeters to over six and a half feet (two meters) in length. The dominant mode of reproduction for staghorn coral is asexual fragmentation, with new colonies forming when branches break off a colony and attach to the substrate. Similar to elkhorn coral, sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female. This coral exhibits the fastest growth of all known western Atlantic corals, with branches increasing in length by four to eight inches (ten to 20 centimeters) per year. Staghorn coral has been one of the three most important Caribbean corals in terms of its contribution to reef growth and fish habitat. Staghorn coral occur in back reef and fore reef environments from 0-98 feet (0-30 meters) deep. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Staghorn coral occur on the Florida Reef Tract north of the Florida Keys off the Atlantic coast of southeast Florida, and colonies are also found throughout the Florida Keys, the Bahamas and the Caribbean islands. This coral occurs in the western Gulf of Mexico, but is absent from United States waters in the Gulf of Mexico. It also occurs in Bermuda and the west coast of South America. The northernmost documented colony of staghorn coral occurs offshore from Palm Beach County, Florida. The greatest source of region-wide mortality for staghorn coral has been disease outbreaks, mainly of white band disease. Other, more localized losses have been caused by hurricanes, increased predation, bleaching, algae overgrowth, human impacts and other factors. This species is particularly susceptible to damage from sedimentation and is sensitive to temperature and salinity variation.

Staghorn coral may be found outside the waters of Florida Bay, specifically within the offshore reef track of the Florida Keys where salinities are stable (35 parts per thousand) and more representative of open ocean conditions. The reef tract is approximately 10 to 20 miles seaward of the shoreline. Anticipated salinity alterations resulting from project activities are not expected to occur beyond 1500 meters from shore. Because the reef tract where staghorn coral resides is several miles outside of any projected salinity changes, the USACE has determined the proposed project would have no effect on staghorn coral.

A.4.6.1.2.1 Staghorn Coral Critical Habitat

Salinities, due to project operations, will not be altered in the vicinity of critical habitat designated for staghorn coral; therefore, the project would have no effect on critical habitat for this species.

A.4.6.2 "May Affect, But Not Likely to Adversely Affect" Determination

Federally listed plant and animal species which may have the potential to be affected by the project are discussed in detail below:

A.4.6.2.1 American Crocodile and "May Affect, But Not Likely to Adversely Affect" Determination

Crocodiles are known to exist throughout the project area (Cherkiss, 1999). The cooling canals of Florida Power and Light's Turkey Point Power Plant, which are in close proximity to project boundary, support the most successful crocodile nesting population in south Florida (Mazzotti et al., 2002). Individuals from this population disperse northward and southward into the C-111 SC project area. These cooling canals offer premium nesting habitat because they satisfy the crocodile's two primary nesting requirements–suitable substrate that lays above the normal high water level and adjacent deep-water refugia. While crocodiles prefer sandy substrates, they will often utilize canal spoil banks (Kushlan and Mazzotti, 1989).

One of the primary project objectives of the C-111 SC Western project is to restore a more natural salinity gradient to the coastal wetlands. Some of the historic watershed flows through Taylor Slough have seeped westward toward the conveyance canals and has robbed these wetlands of vital freshwater for the last several decades, creating an unnaturally high salinity environment, a loss of graminoid marshes and a landward migration of mangrove wetlands. Juvenile crocodiles require low salinity for growth and survival, presumably because they have limited physiological capability to osmoregulate. The ideal salinity range for crocodiles is 0 to 20 parts per thousand (Mazzotti et al., 2002). As salinity levels increase above 20 parts per thousand, habitat suitability decreases. Creating a hydrological barrier to prevent westward seepage from Taylor Slough will redirect freshwater flows into the coastal wetlands lowering the salinities in the Florida Bay estuaries, which should increase suitable habitat for juvenile crocodiles.

Although the American crocodile has a high probability of occurrence within the project area due to the presence of available habitat, no more than minimal temporary impacts are expected as a result of this project. Additionally, as more freshwater is retained in Taylor Slough, overland flows should increase suitable habitat for juvenile crocodiles. Therefore, the project may affect, but is not likely to adversely affect the American crocodile.

A.4.6.2.1.1 American Crocodile Critical Habitat

According to 50 CFR 17.95, the easternmost tip of Turkey Point defines the northern boundary of designated critical habitat for the American crocodile and that boundary extends southwest throughout Florida Bay. Anticipated benefits of the proposed project include improving the quality, quantity, timing, and distribution of water delivered to Central Florida Bay and surrounding waters via overland flows through Taylor Slough. This objective is expected to reduce hyper-salinities in estuarine habitats where critical habitat has been designated for the American crocodile. It is therefore likely that the effects of distributing overland flow through the wetlands into Florida Bay will have effects on tidal wetlands and nearshore salinities that lie within crocodile critical habitat. However, since the ideal salinity range for crocodiles is 0 to 20 parts per thousand, project implementation should enhance crocodile habitat within the project area. It is therefore determined that this project may affect, but not likely adversely affect critical habitat for the American crocodile.

A.4.6.2.2 American Alligator and "May Affect, But Not Likely to Adversely Affect" Determination

The American alligator is listed as threatened by the FWS due to similarity of appearance to another listed species. The American alligator has a high potential for occurring within the project area due to field observations and the presence of available habitat. However, no more than minimal temporary construction impacts to the American alligator are expected as a result of this project. Therefore, the project may affect, but is not likely to adversely affect the American alligator.

A.4.6.2.3 The West Indian Manatee and "May Affect, But Not Likely to Adversely Affect" Determination

The West Indian manatee, or sea cow, is a large, plant-eating aquatic mammal that can be found in the shallow coastal water, rivers, and springs of Florida. Florida is essentially the northern extent of the West Indian manatee's range, though some manatees occasionally are reported from as far north as Virginia and the Carolinas (FP&L, 1989).

The West Indian manatee lives in freshwater, brackish, and marine habitats, and can move freely between salinity extremes. It can be found in both clear and muddy water. Water depths of at least three to seven feet (one to two meters) are preferred and flats and shallows are avoided unless adjacent to deeper water. During the summer months, manatees range throughout the coastal waters, estuaries, bays, and rivers of both coasts of Florida and are usually found in small groups. During the winter, manatees tend to congregate in warm springs, and outfall canals associated with electric generation facilities (FP&L, 1989).

Over the past centuries, the principal sources of manatee mortality have been opportunistic hunting by man and deaths associated with unusually cold winters. Today, poaching is rare, but high mortality rates from human-related sources threaten the future of the species. The largest single mortality factor is collision with boats and barges. Manatees also are killed in flood gates and canal locks, by entanglement or ingestion of fishing gear, and through loss of habitat and pollution (FP&L, 1989).

Manatees have been observed in conveyance canals within the project area, specifically in the lower C-111 Canal just downstream of S-197; and adjacent nearshore seagrass beds throughout Florida Bay including all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee and Buttonwood sounds. The extensive acreages of seagrass beds in the bay provide important feeding areas for manatees. Manatees also depend upon canals as a source of freshwater and resting sites. It is highly likely that manatees also depend on the deep canals as a cold-weather refuge. The relatively deep waters of the canals respond more slowly to temperature fluctuations at the air/water interface than the shallow bay waters. Thus, the canal waters remain warmer than open bay waters during the passage of winter cold fronts.

Development of a hydrological barrier to keep more water in Taylor Slough could result in reducing the frequency of gate openings which may reduce the risk of harm from structures to manatees. Redirecting freshwater from canals should also provide additional drinking water along the shoreline. Although diverted freshwater is expected to change the salinity regime in the nearshore area, seagrass species composition may be altered but should not affect overall seagrass biomass.

Due to the known presence of manatees within the project study area; Standard Manatee Construction Conditions will be implemented during construction of the proposed project to avoid any potential impacts. These measures include the need to avoid vessel equipment collisions with manatees and the use of siltation curtains, during construction to minimize sediment deposition on existing foraging habitat. With the commitment to use the Standard Manatee Construction Conditions, the project may affect but will not likely adversely affect the Florida manatee.

A.4.6.2.3.1 West Indian Manatee Critical Habitat

The main project area lies north of designated critical habitat for the West Indian manatee, however the retention of freshwater in Taylor Slough is expected to increase flow volumes in the downstream estuaries and within the boundaries of designated manatee critical habitat. Diversion of canal water through the wetlands is expected to have localized effects on nearshore salinities, and possibly affect the species composition of seagrass. It is unlikely; however, that the project will adversely affect overall biomass of seagrass, therefore impacts to manatee foraging areas will not be significant. Therefore, the proposed project may affect, but is not likely to adversely affect designated critical habitat for the West Indian manatee.

A.4.6.2.4 Florida Panther and "May Affect, But Not Likely to Adversely Affect" Determination

The panther, also known as cougar, mountain lion, puma and catamount, was once the most widely distributed mammal (other than humans) in North and South America, but it is now virtually exterminated in the eastern U.S. Habitat loss has driven the subspecies known as the Florida panther into a small area, where the few remaining animals are highly inbred, causing such genetic flaws as heart defects and sterility. Recently, closely-related panthers from Texas were released in Florida and are successfully breeding with the Florida panthers. Increased genetic variation and protection of habitat may save the subspecies.

One of 30 cougar subspecies, the Florida panther is tawny brown on the back and pale gray underneath, with white flecks on the head, neck and shoulder. Male panthers weigh up to 130 pounds and females reach 70 pounds. Preferred habitat consists of Cypress swamps, pine and hardwood hammock forests. The main diet of the Florida panther consists of white-tailed deer, sometimes wild hog, rabbit, raccoon, armadillo and birds. Present population estimations range from 30-50 individuals. Panthers are solitary, territorial, often travel at night. Males have a home range of up to 400 square miles and females about 50-100 square miles. Female panthers reach sexual maturity at about 3 years. Mating season is December through February. Gestation lasts about 90 days and females bear two to six kittens. Juvenile panthers stay with their mother for about two years. Females do not mate again until young have left. The main survival threats include habitat loss due to human development and population growth, collision with vehicles, parasites, feline distemper, feline alicivirus (an upper respiratory infection), and other diseases.

Panthers presently inhabit lands in ENP adjacent to the Southern Glades, and radio tracking studies have shown that they venture into the Southern Glades on occasion during post-breeding dispersion. Reference is made to the revised Panther Key and Panther Focus Area Map for use in determining effects to the Florida panther. Phase 1 of the proposed project is within the Primary Zone for Florida panther habitat.

Since potentially suitable habitat occurs within the project area, retention of water in Taylor Slough into coastal wetlands could affect panther habitat. However, as lands in the Southern Glades become restored to their more historic natural value, the concomitant improved prey base would result in greater use by the panther utilizing these areas. Based on this information, and the fact that the panther is a wide-ranging species with the majority of sightings west of the project area, the project may affect, but is not likely to adversely affect the Florida panther.

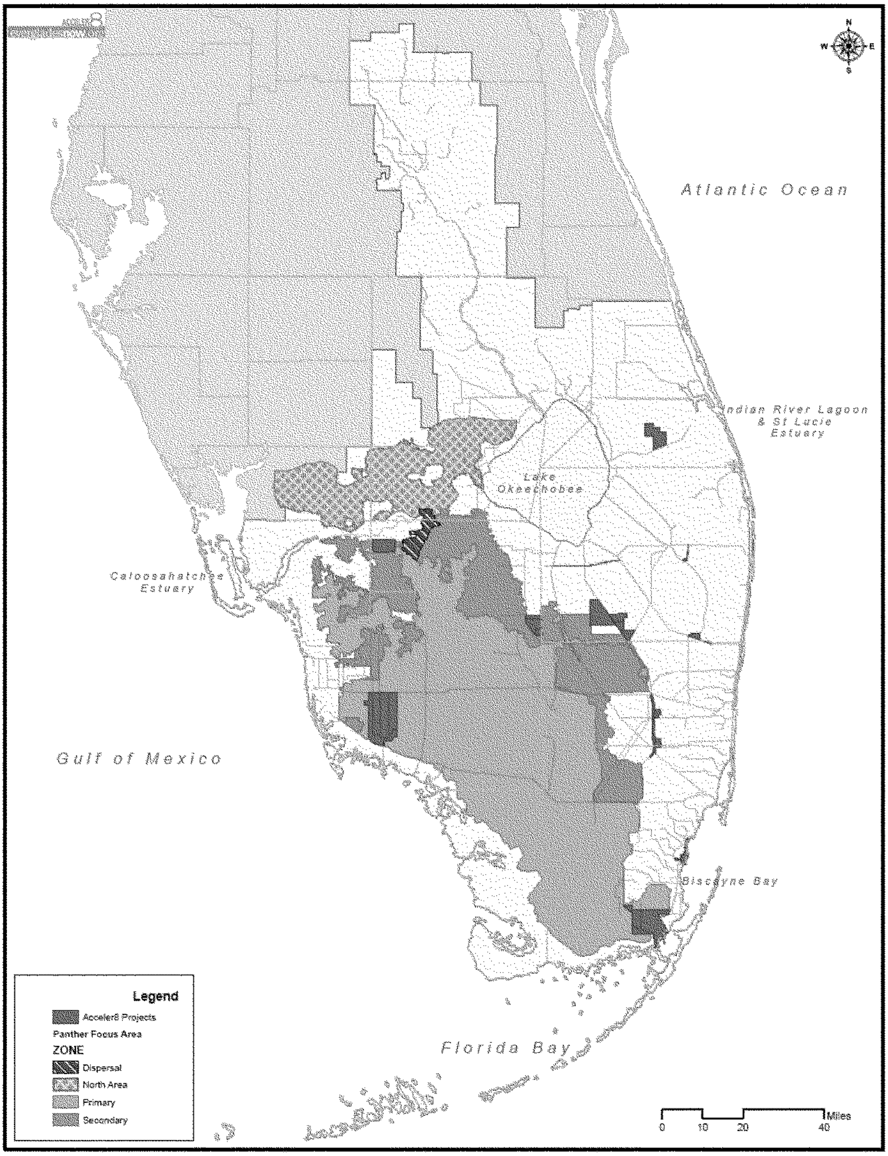

FIGURE A4-9: FLORIDA PANTHER FOCUS AREA MAP

A.4.6.2.5 Smalltooth Sawfish and "May Affect, But Not Likely to Adversely Affect" Determination

Smalltooth sawfish have been reported in the Pacific and Atlantic Oceans, and the Gulf of Mexico; however, the United States population is found only in the Atlantic Ocean and Gulf of Mexico. Historically, the United States population was common throughout the Gulf of Mexico from Texas to Florida, and along the east coast from Florida to Cape Hatteras. The current range of this species includes peninsular Florida, but is relatively common only in the Everglades region at the southern tip of the state.

Juvenile sawfish use shallow habitats with a lot of vegetation, such as mangrove forests, as important nursery areas. Many such habitats have been modified or lost due to development of the coastal areas of Florida and other southeastern states. The loss of juvenile habitat likely contributed to the decline of this species.

The smalltooth sawfish has the potential to be found within Florida Bay, and the juveniles could potentially occur and feed in coastal wetlands. With the proposed project, the smalltooth sawfish may benefit as a result of freshwater flows from Taylor Slough into the coastal wetlands adjoining Florida Bay to provide a more natural and historic overland flow. With the expectation of improved wetland habitat, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the USACE has determined the smalltooth sawfish may be affected, but is not likely to be adversely affected by the proposed project.

A.4.6.2.6 The Wood Stork and "May Affect, But Not Likely to Adversely Affect" Determination

The wood stork is the only stork occurring in the United States. In the United States, the wood stork's range includes Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina, and Texas. The only states in which this bird is known to nest, however, are Florida, Georgia and South Carolina (Mazzotti, 1990).

Wood storks are wetland dwellers and use fresh, brackish and saltwater habitats for feeding and nesting. Feeding takes place in shallow ponds, tidal pools, swamps and marshes. Nesting occurs in cypress, hardwood and mangrove swamps. The extreme dependence of the wood stork on naturally functioning wetlands makes it an excellent indicator of the health of wetland ecosystems (Mazzotti, 1990).

Until the last few decades, the wood stork was a common sight in Florida wetlands. However, between the 1930's and 1960's, there was a serious decline in this species. One reason for the decline in population has been the changes in the hydrologic regime of the Everglades, which affected its foraging habitat and food production (Mazzotti, 1990).

The FWS Standard Local Operating Procedure for Endangered Species (SLOPES) defines the core foraging area for wood storks to be within 18.6 mile (30 kilometer) radius of breeding colonies. Based on research of agency databases, the project area lies within the core foraging area of active wood stork colonies. As a result of this information, the USACE will include conservation measures during construction for the wood stork as outlined in the Habitat Management Guidelines for the Wood Stork in the Southeast Region (FWS, 1990).

Natural foraging areas are expected to increase as normal hydroperiods return to the Everglades proper. This project is designed to enhance or restore wetland habitat functions by rehydrating coastal wetlands and restoring historical overland flows of freshwater into downstream estuaries. With the expectation of improved wetland habitat and the implementation of Habitat Management Guidelines, the USACE has determined the wood stork may be affected, but would not likely be adversely affected by the proposed project.

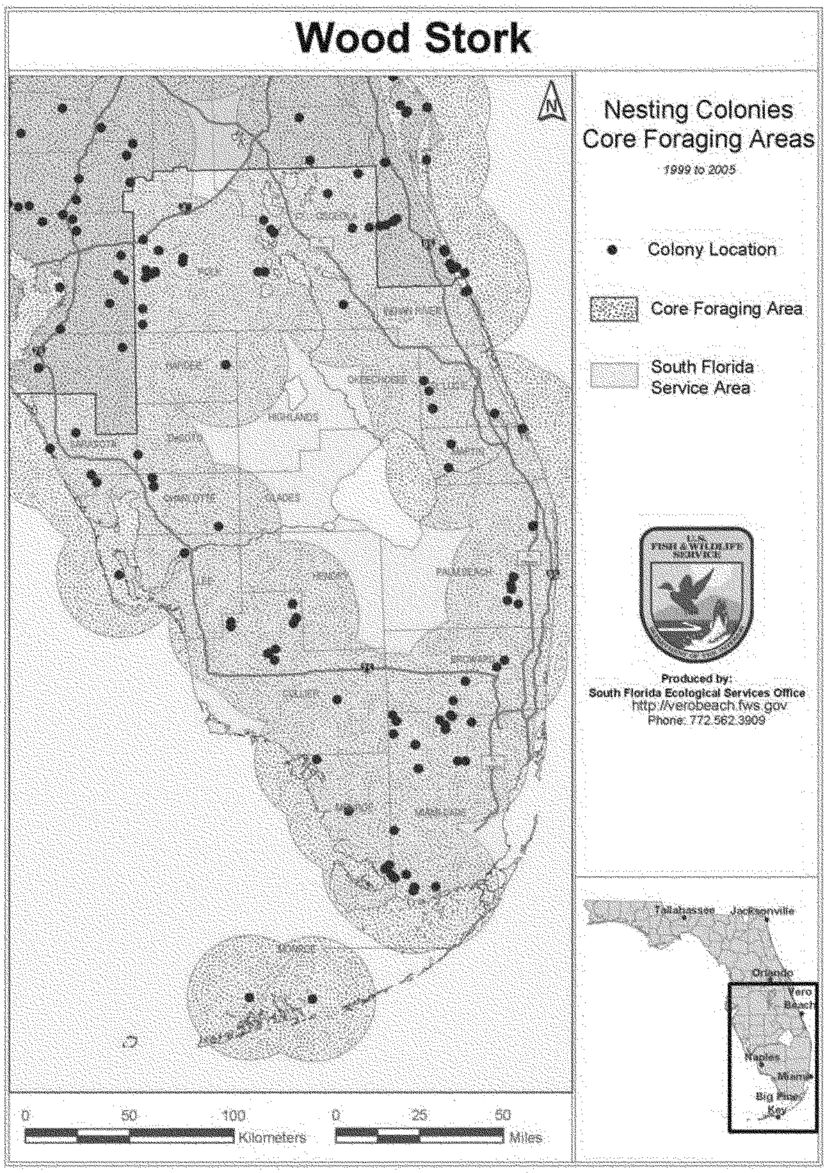

FIGURE A4-10: WOOD STORK NESTING COLONIES

A.4.6.2.7 The Eastern Indigo Snake and "May Affect, But Not Likely to Adversely Affect" Determination

The eastern indigo snake is the largest non-venomous snake in North America. It is an isolated subspecies occurring in southeastern Georgia and throughout peninsular Florida. The Eastern indigo snake prefers drier habitats, but may be found in a variety of habitats from xeric sandhills, to cabbage palm hammocks, to hydric hardwood hammocks (Schaefer and Junkin, 1990). Eastern indigo snakess need relatively large areas of undeveloped land to maintain their population. The main reason for its decline is habitat loss to development. Further, as habitats become fragmented by roads, indigos become increasingly vulnerable to highway mortality as they travel through their large territories (Schaefer and Junkin, 1990).

In south Florida, the Eastern indigo snake is thought to be widely distributed. Given their preference for upland habitats, Eastern indigo snakes are not commonly found in great numbers in the wetland complexes of the Everglades region, even though they are found in pinelands, tropical hardwood hammocks, and mangrove forests in extreme south Florida (Duellman and Schwartz, 1958; Steiner et al., 1983).

Since indigo snakes occur primarily in upland areas their presence in the project area is somewhat limited. The hydrologic effects of the proposed project are expected to benefit existing or historic wetlands and are not expected to have significant effects on the upland habitats preferred by this species. However, due to likelihood that this species may occupy wetland and mangrove habitats, standard protection measures regarding the Eastern indigo snake and associated gopher tortoise burrows will be included in the environmental protection plan when the USACE proceeds to the plans and specifications phase for this project. As a result of implementing this measure, the USACE has determined the Eastern indigo snake may be affected, but is not likely to be adversely affected by the proposed project.

A.4.6.2.8 Schaus Swallowtail Butterfly and "May Affect, But Not Likely to Adversely Affect" Determination

The Schaus swallowtail butterfly is a large dark brown and yellow butterfly originally listed as an endangered species because of population declines caused by the destruction of its tropical hardwood hammock habitat, mosquito control practices, and over-harvesting by collectors.

The present distribution of the Schaus swallowtail extends from southern Miami-Dade County through the Keys in Biscayne Bay and north to southern Key Largo in the Upper Keys, to Lower Matecumbe Key in the Middle Keys. Schaus swallowtail butterfly distribution is limited to tropical hardwood hammocks and is concentrated in the insular portions of Miami-Dade and Monroe counties, from Elliott Key in BNP and associated smaller Keys to central Key Largo (FWS, 1999).

Suitable habitat remaining from historical values for this species is estimated as 43 percent in BNP and 17 percent for north Key Largo. The decline has been attributed primarily to habitat destruction (FWS, 1999). Due to the lack of preferred subtropical hardwood hammock habitat in the project area, the USACE has determined that the proposed project may affect, but would not likely adversely affect the Schaus swallowtail butterfly.

A.4.6.2.9 The Crenulated Lead Plant, Garber's Spurge, Tiny Polygala, and "May Affect, But Not Likely to Adversely Affect" Determination

The primary habitat for these listed plant species are pine rocklands; this habitat is scarce in the project area, primarily in the rocky glades surrounding the Frog Pond area; and any effect on pine rocklands from project implementation is expected to be insignificant. Therefore, the USACE has determined the project may affect, but is not likely to adversely affect the crenulated lead plant, Garber's spurge, and tiny polygala.

A.4.6.2.10 Green Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

The green sea turtle weighs approximately 150 kilograms and lives in tropical and sub-tropical waters. Areas that are known as important feeding areas for the green turtles in Florida include the Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key. Green turtles occupy three habitat types: high energy oceanic beaches, convergence zones in the pelagic habitat, and benthic feeding grounds in the relatively shallow, protected waters. Females deposit eggs on high energy beaches, usually on islands, where a deep nest cavity can be dug above the high water line. Hatchlings leave the beach and move in the open ocean. Green sea turtles forage in pastures of seagrasses and/or algae, but small green turtles can also be found over coral reefs, worm reefs, and rocky bottoms.

Although green sea turtles are expected to be found foraging in nearshore seagrass habitats within Florida Bay, the increased freshwater flows associated with Phase 1 of the C-111 SC project may alter seagrass species composition but should not have an adverse effect on the overall biomass available for sea turtle feeding habits. Additionally, no green sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the USACE has determined the green sea turtle may be affected, but is not likely to be adversely affected by the proposed project.

A.4.6.2.11 Hawksbill Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

The hawksbill sea turtle is a small to medium-sized marine turtle weighing up to 15 kilograms in the United States. The hawksbill lives in tropical and sub-tropical waters of the Atlantic, Pacific, and Indian Oceans. Areas that are known as important feeding areas for hawksbill turtles in Florida include the waters near the Florida Keys and on the reefs off Palm Beach County. Hawksbill turtles use different habitat types at different stages of their life cycle. Post hatchlings take shelter in weed lines that accumulate at convergence zones. Coral reefs are the foraging habitat of juveniles, sub-adults, and adults. They are also known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore where coral reefs are absent. Hawksbills feed predominantly on sponges and nest on low and high energy beaches, frequently sharing the high-energy beaches with green sea turtles. Nests are typically placed under vegetation.

Although hawksbill sea turtles are expected to be found foraging near hardbottom habitats within Florida Bay, the increased freshwater flows associated with Phase 1 of the C-111 SC project may reduce nearshore salinity concentrations but should not have an adverse effect on sponges or other food sources utilized by this species. Additionally, no hawksbill sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the USACE has determined the hawksbill sea turtle may be affected, but is not likely to be adversely affected by the proposed project.

A.4.6.2.12 Leatherback Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

The leatherback sea turtle is the largest living turtle and weighs up to 700 kilograms. The leatherback lives in tropical and sub-tropical waters. Habitat requirements for juvenile and post-hatchling leatherbacks are virtually unknown. Nesting females prefer high-energy beaches with deep unobstructed access. Leatherbacks feed primarily on jellyfish.

Although leatherback turtles are expected to be found foraging in nearshore habitats within Florida Bay, the increased freshwater flows associated with the C-111 SC Western project may reduce nearshore salinity concentrations but should not have an adverse effect on jellyfishes or other food sources utilized by this species. Additionally, no leatherback sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the USACE has determined the leatherback sea turtle may be affected, but would not likely be adversely affected by the proposed project.

A.4.6.2.13 Kemp's Ridley Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

The Kemp's ridley sea turtle is the smallest of all sea turtles and weighs up to 45 kilograms. This species is a shallow water benthic feeder consuming mainly algae and crabs. Juveniles grow rapidly. Juveniles and sub-adults have been found along the eastern seaboard of the United States and in the Gulf of Mexico. However, the major nesting beach for the Kemp's ridley sea turtle is on the northeastern coast of Mexico.

This species occurs mainly in coastal areas of the Gulf of Mexico and in the northwestern Atlantic Ocean. The post-pelagic stages are commonly found dwelling over crab-rich sandy or muddy bottoms. Juveniles frequent bays, coastal lagoons, and river mouths.

Although Kemp's ridley sea turtles could be found foraging in nearshore habitats within Florida Bay, this species is not expected to be found within the direct area of influence associated with Phase 1 of the C-111 SC project. Additionally, no Kemp's ridley sea turtles would attempt to utilize areas for nesting purposes since their main nesting location is on a single stretch of beach on the Gulf Coast of Mexico. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the USACE has determined the Kemp's ridley sea turtle may be affected, but would not likely be adversely affected by the proposed project.

A.4.6.2.14 Loggerhead Sea Turtle and "May Affect, But Not Likely to Adversely Affect" Determination

Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Females select high energy beaches on barrier strands adjacent to continental land masses for nesting. Steeply sloped beaches with gradually sloped offshore approaches are favored. After leaving the beach, hatchlings swim directly offshore and eventually are found along drift lines. They migrate to the near-shore and estuarine waters along the continental margins and utilize those areas as the developmental habitat for the sub-adult stage. Loggerheads are predators of benthic invertebrates.

Although loggerhead sea turtles are expected to be found foraging in nearshore habitats within Florida Bay, the increased freshwater flows associated with Phase 1 of the C-111 SC project may reduce nearshore salinity concentrations but should not have an adverse effect on crustaceans, mollusks or other invertebrate food sources utilized by this species. Additionally, no loggerhead sea turtles would attempt to utilize areas for nesting purposes since there is no suitable habitat for nesting in the project area. With the expectation of improved nearshore habitat, no utilization of the project area for nesting purposes, and the implementation of agency approved Sea Turtle and Smalltooth Sawfish Construction Conditions, the USACE has determined the loggerhead sea turtle may be affected, but would not likely be adversely affected by the proposed project.

A.4.6.3 "May Affect, Likely to Adversely Affect" Determination

Federally listed plant and animal species which may have the potential to be adversely affected by the project are discussed in detail below:

A.4.6.3.1 Cape Sable Seaside Sparrow and "May Affect, Likely to Adversely Affect" Determination

Cape Sable seaside sparrows (CSSS) are medium sized sparrows restricted to the Florida peninsula. They are non-migratory residents of freshwater to brackish marshes. The CSSS are known to nest in mixed marl prairie communities that often include muhly grass (*Muhlenbergia filipes*). These short-hydroperiod (the period of time during which a wetland is covered by water) prairies contain moderately dense, clumped grasses, with open space permitting ground movements by the sparrows. They commonly feed on soft-bodied insects from low-lying vegetation and avoid sites with permanent water cover.

The CSSS tends to avoid tall, dense, sawgrass-dominated communities, spike rush (*Eleocharis* spp.) marshes, extensive cattail (*Typha* spp.) monocultures, long-hydroperiod wetlands with tall, dense vegetative cover, and sites supporting woody vegetation (Werner, 1975; Bass and Kushlan, 1982). CSSS also avoid sites with permanent water cover (Curnutt and Pimm, 1993). The suitability of short-hydroperiod Everglades, mixed marl prairie communities for the CSSS, is driven by a combination of hydroperiod and periodic fire events (Kushlan and Bass, 1983).

CSSS build their nests relatively close to the ground. The average early season nest height is 17 cm (6.7") above ground, while the average late season nest height is 21 cm (8.3") (Lockwood et al., 2001). The shift in average nest height after the onset of the wet season rainfall pattern, which typically begins in early June (Lockwood et al., 2001), appears to be an adaptive response to rising surface water conditions. While the majority of nesting activities have been observed when Everglades marl prairies are dry, between March 1 and July 15 (Lockwood et al., 1997; 2001), nesting has been reported as early as late February (Werner, 1975), and as late as early August (Dean and Morrison, 2001).

In the 1930s, Cape Sable was the only known breeding range for the CSSS (Nicholson 1928). Areas on Cape Sable that were occupied by CSSS in the 1930s have experienced a shift in vegetative communities from freshwater vegetation to mangroves, bare mud flats, and salt-tolerant plants, such as *Batis maritima* and *Borrichia frutescens* (Kushlan and Bass, 1983). As a result, CSSS no longer use this area. More recently, continued alterations of CSSS habitat have occurred as a result of changes in the distribution, timing, and quantity of water flows in south Florida. Water flow changes appear to be the leading contributor to the decline in sparrow population, which subsequently threatens the subspecies with extinction. Competition and predation also threatens the CSSS. Raccoons *(Procyon lotor*), snakes, rice rats *(Oryzomys palustris*), and hawks may be the chief predators.

Presently, the known distribution of the CSSS is restricted to two areas of marl prairies east and west of Shark River Slough in the Everglades region (within ENP and Big Cypress National Preserve) and the edge of Taylor Slough in the Southern Glades Wildlife and Environmental Area in Miami-Dade County. These areas are divided into six separate subpopulations or designated areas of CSSS critical habitat (***FIGURE A4-11***). Total CSSS populations have declined from approximately 6,600 individuals during the period from 1981-1992, to 3,184 in 2007 (Everglades National Park). Although populations decreased significantly during the early part of that time period, they have remained relatively constant since 1993 (***TABLE A4-3).***

Subpopulations C and D (Units 2 and 3) are the closest prairie habitat and CSSS sub-populations in or near the project area. Subpopulation D lies within the upper C-111 Canal and extends westward into the Aerojet Road component of the project. Subpopulation C lies on the eastern edge of Taylor Slough just north of SR 9336 and west of L-31W (***FIGURE A4-12***). Subpopulation B (Unit 1) lies further south of State Road 9336 on the western edge of Taylor Slough. The marl prairie/wet prairie habitat in subpopulation C has supported an estimated average of 102 CSSS individuals over the past 5 years; while subpopulation D, where the vegetation has been affected recently by longer hydroperiods, has averaged less than 10 individuals over the same period of time (***FIGURE A4-13***).

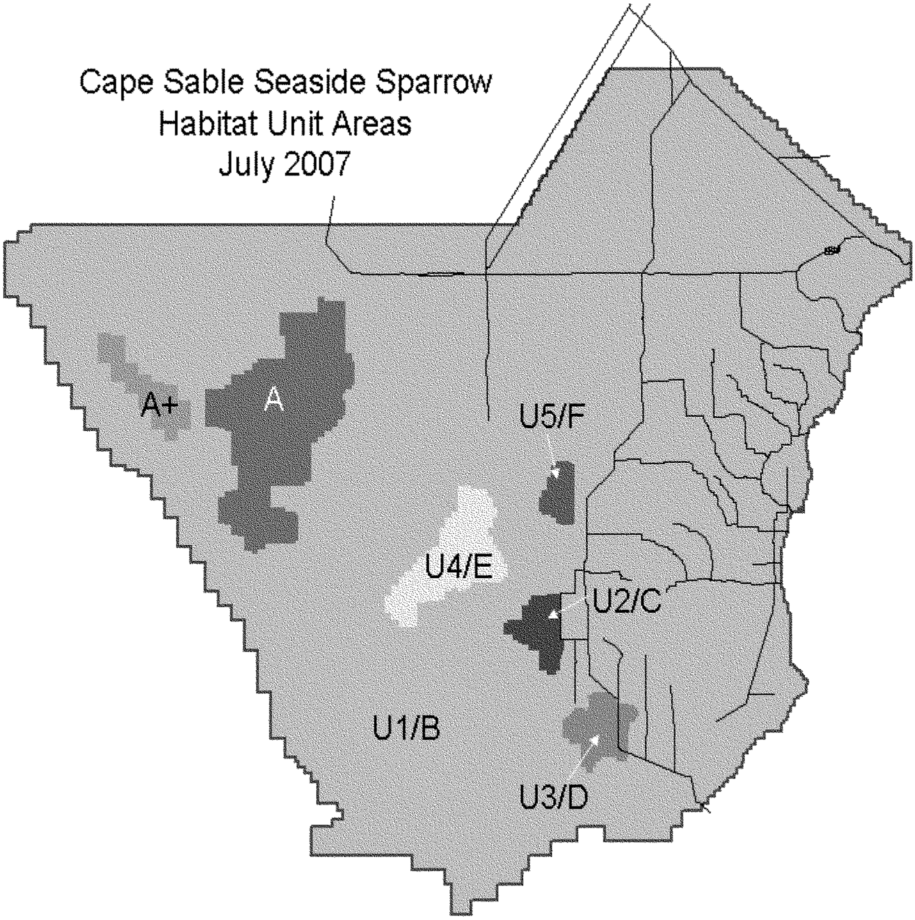

FIGURE A4-11: CAPE SABLE SEASIDE SPARROW DESIGNATED CRITICAL HABITAT

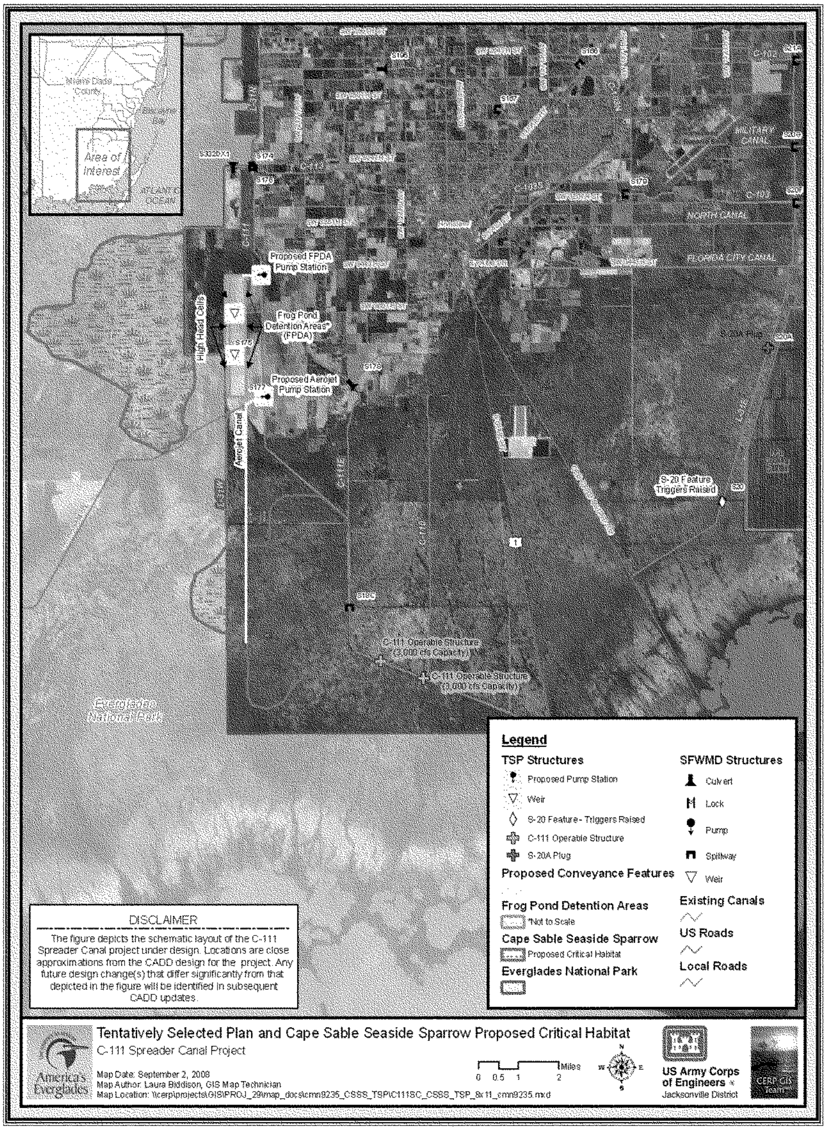

FIGURE A4-12: LOCATION OF CAPE SABLE SEASIDE SPARROW CRITICAL HABITAT WITHIN THE PROJECT AREA

TABLE A4-3: CAPE SABLE SEASIDE SPARROW POPULATION SURVEY DATA
(ACTUAL OBSERVATIONS USING A MULTIPLIER OF 16:1)

	1981	1992	1993	1994 *	1995	1996	1997	1998	1999	2000 (a)	2000 (b)	2001	2002	2003	2004	2005	2006	2007 *
A	2688	2608	432	80	240	384	272	192	400	448	400	128	96	128	16	96	112	64
B	2352	3184	2464	2224	2128	1888	2832	1808	2048	1824	2448	2128	1824	2368	2784	2272	2080	2512
C	432	48	0		0	48	48	80	144	112	64	96	112	96	128	80	160	48
D	400	112	96		0	80	48	48	176	64	16	32	0	0	0	48	0	0
E	672	592	320	112	352	208	832	912	768	1040	704	848	576	592	640	576	704	560
F	112	32	0		0	16	16	16	16	0	112	32	16	32	16	32	32	0
Total	**6656**	**6576**	**3312**	**2416**	**2720**	**2624**	**4048**	**3056**	**3552**	**3488**	**3744**	**3264**	**2624**	**3216**	**3584**	**3104**	**3088**	**3184**

Total CSSS populations have declined from approximately 6,600 individuals during the period from 1981-1992, to 3,184 in 2007 (Everglades National Park, 2008).

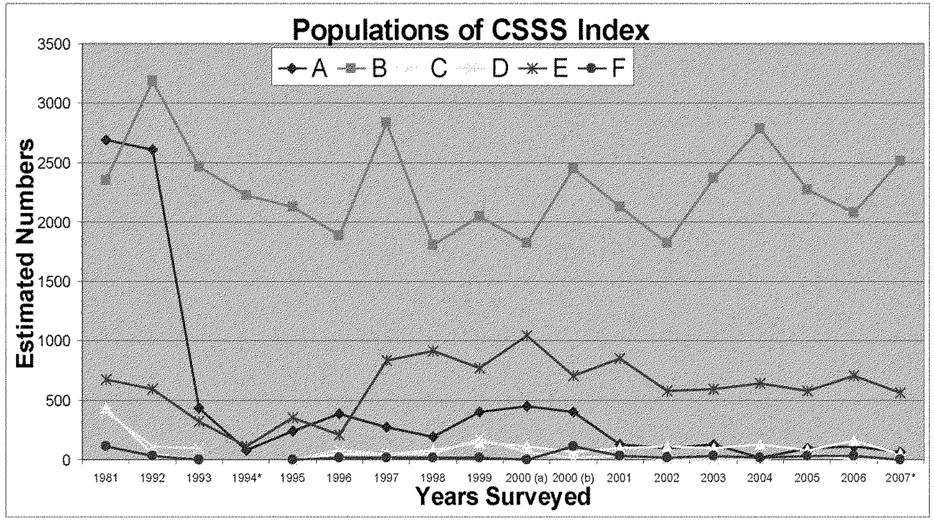

FIGURE A4-13: ESTIMATED CAPE SABLE SEASIDE SPARROW POPULATIONS WITHIN EACH CRITICAL HABITAT UNIT

A.4.6.3.2 Potential Effects to CSSS

In evaluating project impacts to the CSSS, a hydrological model (MODBRANCH) was utilized for a comparison of existing (baseline) and future with-project (the Recommended Plan) scenarios. Model output focused on the total areas of specified hydroperiods; maximum continuous dry periods; the amount of dry days during the nesting season; and areas potentially containing water depths greater than 20 cm within subpopulations C and D (***TABLE A4-4*** through ***TABLE A4-11***).

Although the proposed restoration project attempts to increase flows in Taylor Slough by reducing groundwater seepage created by adjacent canals and structures, the project potentially raises groundwater levels in sensitive areas, specifically in designated critical habitat subpopulation D, which could result in longer hydroperiods. This puts additional stress on habitats where the vegetative communities are already transitioning into sawgrass dominated freshwater wetlands; not necessarily conducive for successful CSSS nesting.

As stated, favorable nesting habitat requires short hydroperiod vegetation characteristic of mixed marl prairie communities. A measure of the potential for CSSS nesting success is the number of consecutive days between March 1 and July 15 that water levels are below ground surface. Preferable discontinuous hydroperiod durations range from 60 to 180 days, although a 40 to 80 consecutive day period is considered favorable (Pimm et al., 2003).

Initial analyses of the MODBRANCH model output indicate minor changes to hydroperiods in with-project conditions compared to the existing baseline condition within subpopulation C. As a result of project implementation, no adverse impacts are anticipated on continued nesting opportunities in subpopulation C. In subpopulation D, however, average year simulations indicate a potential significant increase in hydroperiods within the nesting area of subpopulation D; the result of which could alter the vegetative composition over time.

As a result of potentially increased hydroperiods, some acreage of critical habitat in CSSS subpopulation D may no longer support a hydroperiod in the 60 to 180 day window that is required to sustain the vegetative composition favored by CSSS for nesting. ***FIGURE A4-14*** illustrates the location of altered hydroperiods for the 1978 (Average) MODBRANCH model year output in reference to the locations and frequency of CSSS in Sub-population D.

FIGURE A4-14: LOCATION OF CAPE SABLE SEASIDE SPARROW CRITICAL HABITAT, SURVEY SITES, NUMBERS OBSERVED, AND RELATIONSHIP TO C-111 SPREADER CANAL PROJECT (PHASE 1)

TABLE A4-4: TOTAL AREA WITH SPECIFIED HYDROPERIODS

Hydroperiod (days)	Base Avg Year	W/Proj Avg Year	Base Dry Year	W/Proj Dry Year	Base Wet Year	W/Proj Wet Year
CSSS Habitat: Unit 2 (8,304 ac)						
<15	3094.2	1949.7	8304.3	8304.3	0	0
15 - 29	733.8	352	0	0	5.8	0
30 - 44	674.9	773.5	0	0	18.6	0
45 - 59	573.8	547.2	0	0	54.2	0
60 - 74	897.8	1176.3	0	0	43.9	0
75 - 89	400.7	941.1	0	0	117.7	0
90 - 104	607	624.3	0	0	473.9	0
105 - 119	652.6	445	0	0	1182.5	5.8
120 - 134	669.5	1458	0	0	1648.5	1231.9
135 - 149	0	37.2	0	0	923.1	513.6
150 - 164	0	0	0	0	359.6	1769.2
165 - 179	0	0	0	0	530.9	930
180 - 194	0	0	0	0	600.3	656.9
195 - 209	0	0	0	0	500	754.3
210 - 224	0	0	0	0	159	379.6
225 - 239	0	0	0	0	216.5	712.8
240 - 254	0	0	0	0	366.4	508.7
255 - 269	0	0	0	0	702.4	841.6
270 - 284	0	0	0	0	401.2	0
285 - 299	0	0	0	0	0	0
300 - 314	0	0	0	0	0	0
315 - 329	0	0	0	0	0	0
330 - 344	0	0	0	0	0	0
345 - 359	0	0	0	0	0	0
360 - 365	0	0	0	0	0	0

TABLE A4-5: TOTAL AREA WITH SPECIFIED MAXIMUM CONTINUOUS DRY PERIOD 1 MARCH - 15 JULY

CSSS Habitat: Unit 2 (8,304 ac)						
Max Continuous dry period (days)	**Base Avg Year**	**W/Proj Avg Year**	**Base Dry Year**	**W/Proj Dry Year**	**Base Wet Year**	**W/Proj Wet Year**
= 0	0	0	0	0	0	0
1 - 5	0	0	0	0	0	0
6 - 10	0	0	0	0	0	0
11 - 15	0	0	0	0	0	0
16 - 20	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0
51 - 55	0	0	0	0	0	0
56 - 60	0	0	0	0	0	0
61 - 65	0	0	0	0	0	0
66 - 70	0	0	0	0	0	0
71 - 75	0	0	0	0	0	0
76 - 80	0	0	0	0	0	0
81 - 85	0	0	0	0	0	0
86 - 90	0	0	0	0	37.2	0
91 - 95	0	0	0	0	334.2	0
96 - 100	0	0	0	0	581.6	262.7
101 - 105	0	0	0	0	591.9	977.6
106 - 110	0	0	0	0	0	0
111 - 115	0	0	0	0	5648.3	5385.2
116 - 120	0	0	0	0	18.7	10.8
121 - 125	0	0	0	0	0	26
126 - 130	0	0	0	0	0	21.8
131 - 135	0	0	0	0	0	192.3
136 - 140	8304.3	8304.3	8304.3	8304.3	1092.4	1427.9

TABLE A4-6: TOTAL AREA WITH SPECIFIED # OF DRY DAYS 1 MARCH - 15 JULY

CSSS Habitat: Unit 2 (8,304 ac)						
Number of Dry days	**Base Year Avg**	**W/Proj Year Avg**	**Base Year Dry**	**W/Proj Dry Year**	**Base Year Wet**	**W/Proj Year Wet**
= 0	0	0	0	0	0	0
1 - 5	0	0	0	0	0	0
6 - 10	0	0	0	0	0	0
11 - 15	0	0	0	0	0	0
16 - 20	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0
51 - 55	0	0	0	0	0	0
56 - 60	0	0	0	0	0	0
61 - 65	0	0	0	0	0	0
66 - 70	0	0	0	0	0	0
71 - 75	0	0	0	0	0	0
76 - 80	0	0	0	0	0	0
81 - 85	0	0	0	0	0	0
86 - 90	0	0	0	0	0	0
91 - 95	0	0	0	0	334.2	0
96 - 100	0	0	0	0	127	104.9
101 - 105	0	0	0	0	491.9	266.5
106 - 110	0	0	0	0	173.2	470.2
111 - 115	0	0	0	0	785.8	1051.1
116 - 120	0	0	0	0	353.4	524.3
121 - 125	0	0	0	0	91.5	415.6
126 - 130	0	0	0	0	822.5	388.8
131 - 135	0	0	0	0	1297.2	751.6
136 - 140	8304.3	8304.3	8304.3	8304.3	3827.7	4331.3

TABLE A4-7: TOTAL AREA WITH SPECIFIED MAXIMUM PERIOD DEPTH > 20CM 15 MARCH - 30 JUNE

CSSS Habitat: Unit 2 (8,304 ac)						
Max Continuous period depth>20cm (days)	Base Year Avg	W/Proj Year Avg	Base Dry Year	W/Proj Dry Year	Base Year Wet	W/Proj Year Wet
= 0	8304.3	8304.3	8304.3	8304.3	8304.3	8287.8
1 - 5	0	0	0	0	0	16.6
6 - 10	0	0	0	0	0	0
11 - 15	0	0	0	0	0	0
16 - 20	0	0	0	0	0	0
21 - 25	0	0	0	0	0	0
26 - 30	0	0	0	0	0	0
31 - 35	0	0	0	0	0	0
36 - 40	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0
51 - 55	0	0	0	0	0	0
56 - 60	0	0	0	0	0	0
61 - 65	0	0	0	0	0	0
66 - 70	0	0	0	0	0	0
71 - 75	0	0	0	0	0	0
76 - 80	0	0	0	0	0	0
81 - 85	0	0	0	0	0	0
86 - 90	0	0	0	0	0	0
91 - 95	0	0	0	0	0	0
96 - 100	0	0	0	0	0	0
101 - 105	0	0	0	0	0	0
106 - 110	0	0	0	0	0	0
111 - 115	0	0	0	0	0	0

TABLE A4-8: TOTAL AREA WITH SPECIFIED HYDROPERIODS

CSSS Habitat: Unit 3 (10,808 ac)						
Hydroperiod (days)	Base Year Avg	W/Proj Year Avg	Base Dry Year	W/Proj Dry Year	Base Year Wet	W/Proj Year Wet
<15	88.7	0	10678.5	10618.3	36.6	40.8
15 - 29	127.8	0	11.9	60.2	91.8	48.7
30 - 44	231.5	0	26.8	11.9	52.6	55.3
45 - 59	610.4	0	31.8	38.9	28.8	57.4
60 - 74	517.3	18.4	21.4	41.1	15.8	80.5
75 - 89	907.5	0	0	0	32	114.1
90 - 104	1179.3	0	24.6	11.8	75.8	142.6
105 - 119	1165.1	651.5	11.2	24	59.3	319.2
120 - 134	1575.5	893.5	0	0	208.6	232.1
135 - 149	1442.3	1105.3	0	0	809.3	416.7
150 - 164	1008.8	1331.6	0	0	801.2	541.9
165 - 179	1118.7	3157.1	0	0	881.8	406.6
180 - 194	440.1	2542.5	0	0	1320.5	865.4
195 - 209	127.6	770.9	0	0	1823.6	1326
210 - 224	49.1	93	0	0	1405.9	1531.9
225 - 239	44.2	62.1	0	0	813.8	1022.8
240 - 254	13.2	7.9	0	0	639.1	1107.4
255 - 269	34.4	30.2	0	0	247.4	676.4
270 - 284	0	17.3	0	0	852.3	728.2
285 - 299	0	0	0	0	294.5	544.5
300 - 314	21	9.1	0	0	91.4	249.2
315 - 329	39.9	26.8	0	0	71.7	74.5
330 - 344	8.5	33.5	0	0	27.4	71.7
345 - 359	55.5	44.3	0	0	0	27.4
360 - 365	0	11.2	0	0	124.9	124.9

TABLE A4-9: TOTAL AREA WITH SPECIFIED MAXIMUM CONTINUOUS DRY PERIOD 1 MARCH - 15 JULY

CSSS Habitat: Unit 3 (10,808 ac)						
Max Continuous dry period (days)	**Base Year Avg**	**W/Proj Year Avg**	**Base Year Dry**	**W/Proj Dry Year**	**Base Year Wet**	**W/Proj Year Wet**
= 0	0	0	0	0	103.9	124.9
1 - 5	0	24	0	0	21	14.3
6 - 10	35.8	31.5	0	0	0	13.2
11 - 15	0	0	0	0	27.4	46.5
16 - 20	19.7	0	0	0	8.5	37.9
21 - 25	20.6	48.4	0	0	16.6	13
26 - 30	27.8	11.9	0	0	68	13.5
31 - 35	21	9.1	0	0	30.3	242.4
36 - 40	0	17.3	0	0	15.3	22.4
41 - 45	25.2	24.9	0	0	0	14
46 - 50	4.3	25.7	0	0	11.2	0
51 - 55	70.3	59.1	0	0	0	10.2
56 - 60	0	0	0	0	68.8	86
61 - 65	0	27.4	0	0	77.6	82.2
66 - 70	30.2	25.2	0	0	122.8	93.9
71 - 75	0	0	0	0	97.4	59.7
76 - 80	310.4	437	0	0	68.1	293.7
81 - 85	12.8	25.7	0	0	110.8	412.5
86 - 90	150.3	478.3	0	0	208.3	705.2
91 - 95	149.6	326.7	0	0	787.9	1063.2
96 - 100	99.6	124.2	0	0	253.1	839.5
101 - 105	34.2	44.9	0	0	364.6	995.4
106 - 110	0	0	0	0	60.2	127.7
111 - 115	186.1	968.1	0	0	7147	5174.8
116 - 120	0	0	0	0	0	0
121 - 125	2256.7	4861.5	0	0	33.2	0
126 - 130	15.7	0	0	0	9	0
131 - 135	8.5	19.3	0	0	64.6	0
136 - 140	7327.4	3215.8	10806.2	10806.2	1030.4	320

TABLE A4-10: TOTAL AREA WITH SPECIFIED # OF DRY DAYS 1 MARCH - 15 JULY

CSSS Habitat: Unit 3 (10,808 ac)						
Number of Dry days	Base Year Avg	W/Proj Year Avg	Base Year Dry	W/Proj Dry Year	Base Year Wet	W/Proj Year Wet
= 0	0	0	0	0	103.9	124.9
1 - 5	0	11.2	0	0	21	0
6 - 10	24	24.6	0	0	0	14.3
11 - 15	11.8	0	0	0	0	13.2
16 - 20	0	19.7	0	0	0	0
21 - 25	19.7	8.5	0	0	0	55.1
26 - 30	8.5	0	0	0	0	8.8
31 - 35	0	25	0	0	14.3	0
36 - 40	12.1	14.9	0	0	30.5	20.6
41 - 45	12.9	0	0	0	0	13.5
46 - 50	14.9	11.9	0	0	54.4	43.9
51 - 55	11.9	9.1	0	0	35	81.4
56 - 60	9.1	0	0	0	4.3	94.2
61 - 65	0	0	0	0	8.4	77.9
66 - 70	0	0	0	0	123.6	57
71 - 75	17.3	20.1	0	0	112.1	109
76 - 80	2.8	35.3	0	0	82.5	323.3
81 - 85	27.4	32.1	0	0	142.5	430.6
86 - 90	21.8	30	0	0	242.1	317.9
91 - 95	28.7	37.7	0	0	643.7	484.6
96 - 100	42.7	102.2	0	0	159.7	234.8
101 - 105	17.2	311	0	0	155.8	432.7
106 - 110	111.9	260.5	0	0	78.9	506.5
111 - 115	43.3	670.9	0	0	1280.5	998
116 - 120	45.4	616.2	0	0	782.5	698.7
121 - 125	408.4	1198.4	0	0	2041.9	1063.3
126 - 130	318.9	1262.7	0	0	1229.1	1247.4
131 - 135	1133.3	1728.5	0	0	1714.2	2302.5
136 - 140	8462	4375.8	10806.2	10806.2	1745	1052.1

TABLE A4-11: TOTAL AREA WITH SPECIFIED MAXIMUM PERIOD DEPTH > 20CM 15 MARCH - 30 JUNE

CSSS Habitat: Unit 3 (10,808 ac)						
Max Continuous period depth>20cm (days)	**Base Avg Year**	**W/Proj Avg Year**	**Base Dry Year**	**W/Proj Dry Year**	**Base Wet Year**	**W/Proj Wet Year**
= 0	10794.9	10770.4	10806.2	10806.2	10642.5	10633.7
1 - 5	0	24.6	0	0	38.8	16
6 - 10	0	0	0	0	60.9	31.6
11 - 15	11.2	11.2	0	0	8.5	33.9
16 - 20	0	0	0	0	19.7	35.5
21 - 25	0	0	0	0	0	0
26 - 30	0	0	0	0	35.8	19.7
31 - 35	0	0	0	0	0	35.8
36 - 40	0	0	0	0	0	0
41 - 45	0	0	0	0	0	0
46 - 50	0	0	0	0	0	0
51 - 55	0	0	0	0	0	0
56 - 60	0	0	0	0	0	0
61 - 65	0	0	0	0	0	0
66 - 70	0	0	0	0	0	0
71 - 75	0	0	0	0	0	0
76 - 80	0	0	0	0	0	0
81 - 85	0	0	0	0	0	0
86 - 90	0	0	0	0	0	0
91 - 95	0	0	0	0	0	0
96 - 100	0	0	0	0	0	0
101 - 105	0	0	0	0	0	0
106 - 110	0	0	0	0	0	0
111 - 115	0	0	0	0	0	0

A.4.6.4 Stage Hydrographs

The following graphics illustrate stages produced by MODBRANCH simulations for an Existing Condition "Without-Project" simulation and an Existing Condition "With-Project" simulation (i.e., what would the hydrologic conditions generally look like if the project existed today). The "Without-Project" condition is shown as an orange line/bar and the "With-Project" Simulation results are shown as a dark-blue line/bar. Stage hydrographs, annual stage durations, and stage durations simulated during the 1-Mar to 15-July breeding window for the CSSS are presented for Average, Dry, and Wet year simulations (i.e., climate conditions observed during 1978, 1989, and 1995 respectively).

The elevation of the model cell corresponding to the area near NTS1 is 5.9 ft NGVD and the elevation of the model cell corresponding to the area near SWEVER4 is 2.8 ft NGVD.

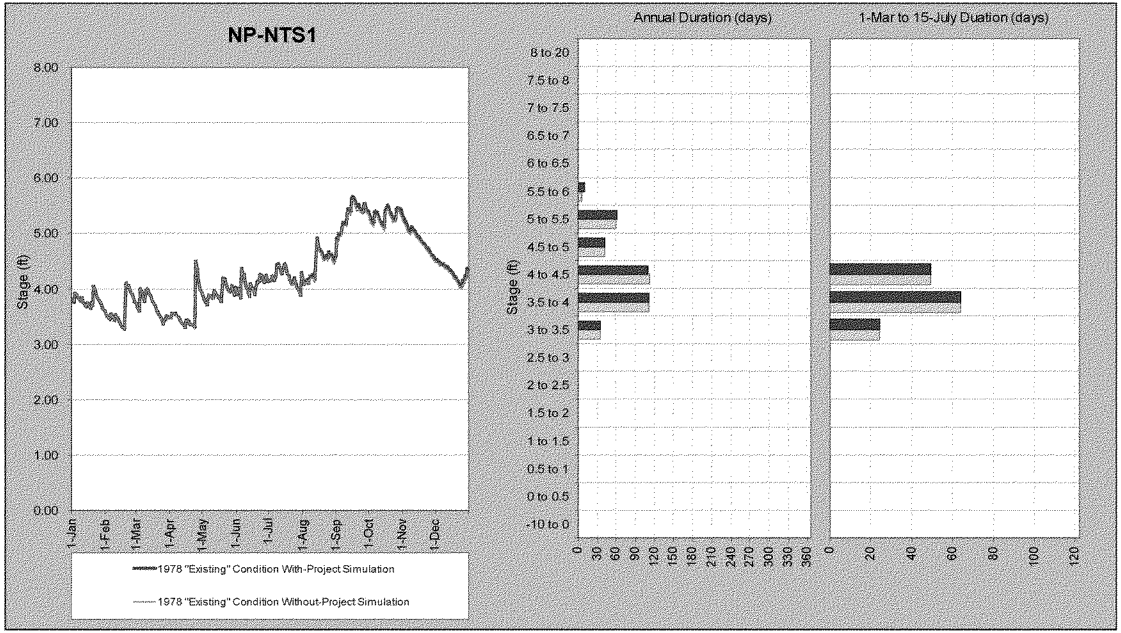

FIGURE A4- 15: AVERAGE YEAR SIMULATION (NTS1 NEAR SUBPOPULATION C)

Stages at/near the location of NTS1 (subpopulation C) simulated for an average year for the with-project condition are not notably different from those simulated for the without-project condition during the year or window for peak nesting activity.

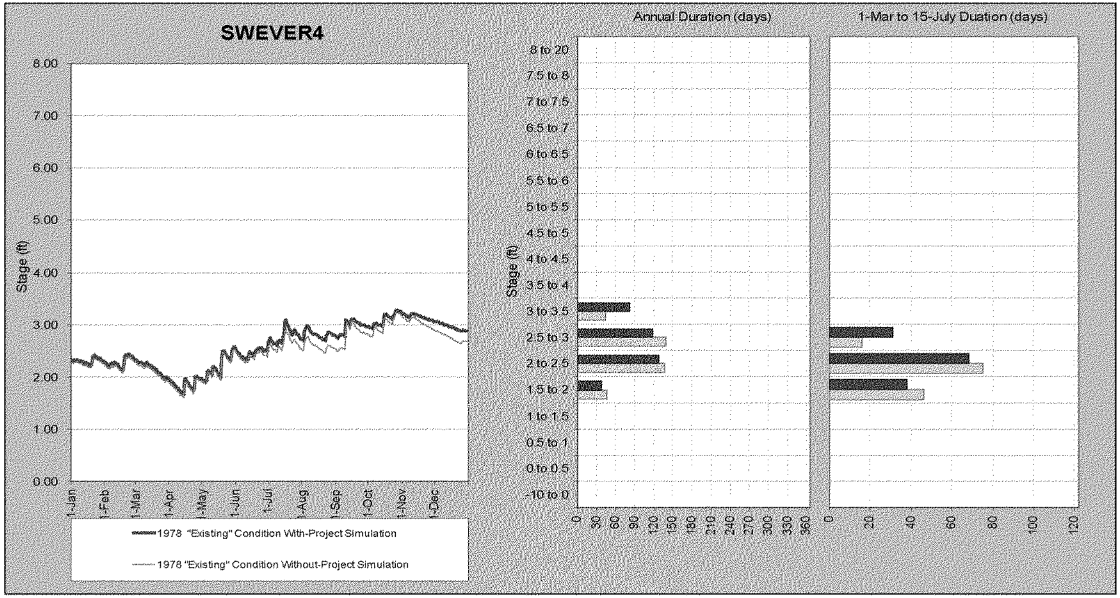

FIGURE A4-16: AVERAGE YEAR SIMULATION (SWEVER4 – SUBPOPULATION D)

Stages at/near the location of SWEVER4 (subpopulation D) simulated for an average year for the with-project condition tend to be slightly higher than those simulated for the without-project condition during the wet season and during the very end of the window for peak nesting activity.

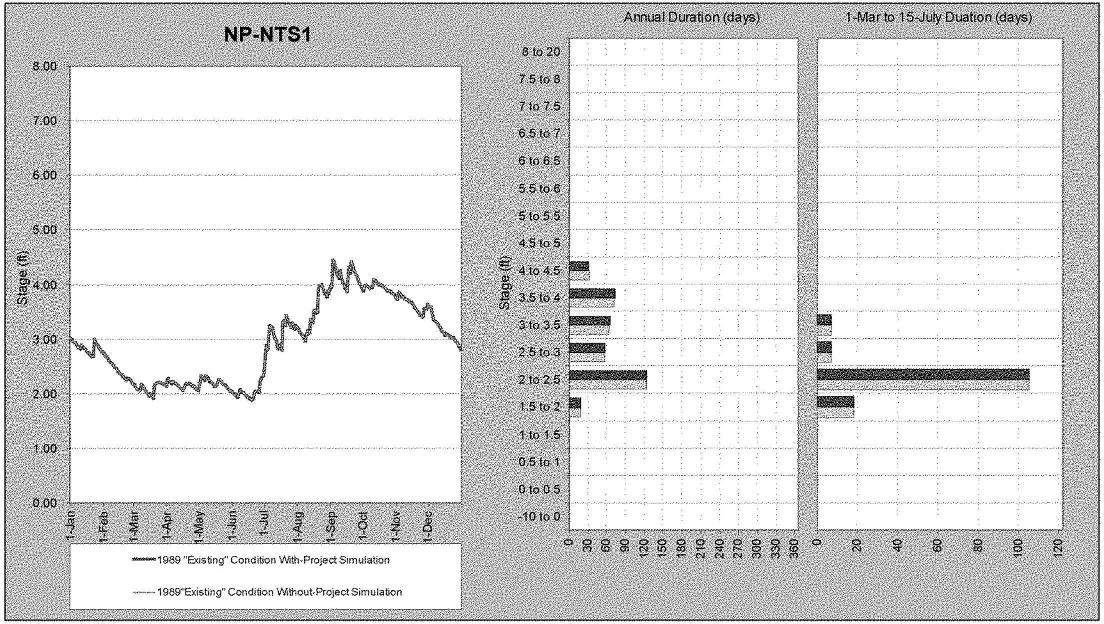

FIGURE A4-17: DRY YEAR SIMULATION (NTS1 NEAR SUBPOPULATION C)

Stages at/near the location of NTS1 (subpopulation C) simulated for a dry year for the with-project condition are not notably different from those simulated for the without-project condition during the year or window for peak nesting activity.

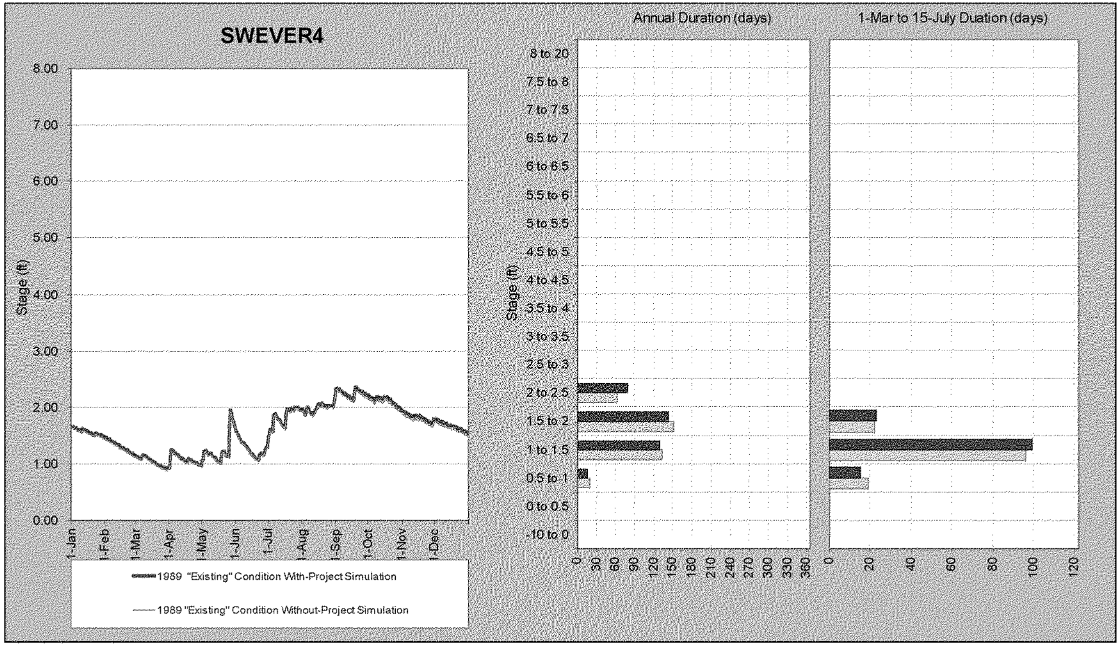

FIGURE A4-18: DRY YEAR SIMULATION (SWEVER4 NEAR SUBPOPULATION D)

Stages at/near the location of SWEVER4 (subpopulation D) simulated for a dry year for the with-project condition are not notably different from those simulated for the without-project condition during the year or window for peak nesting activity.

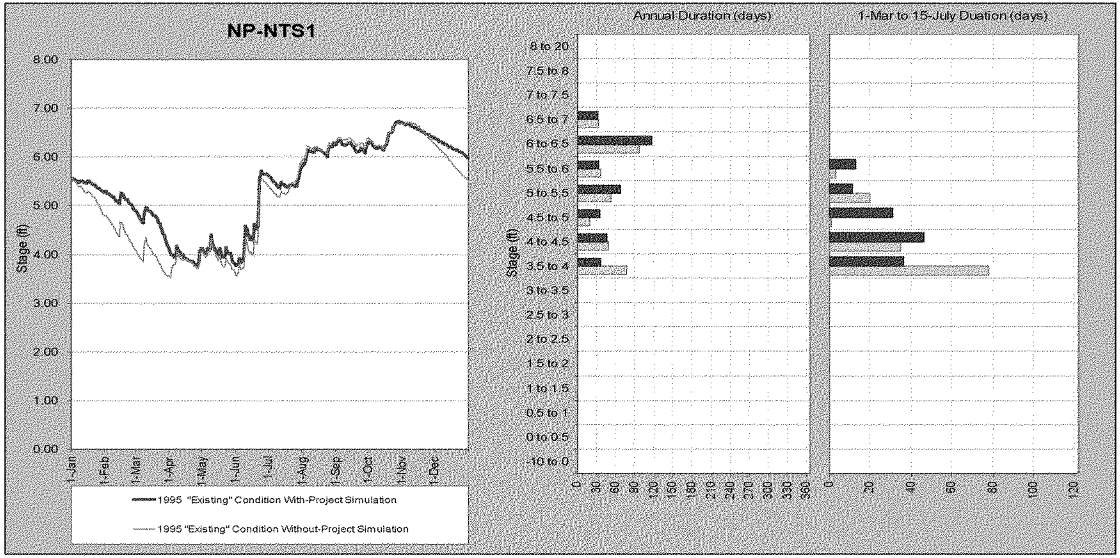

FIGURE A4-19: WET YEAR SIMULATION (NTS1 NEAR SUBPOPULATION C)

Stages at/near the location of NTS1 (subpopulation C) simulated for a wet year for the with-project condition are generally higher than those simulated for the without-project condition prior to and during the window for peak nesting activity. Although the elevation of the model cell corresponding to the area near NTS1 is 5.9 ft NGVD, it seems likely that some local patches of habitat at lower elevations (due to topographic relief beyond the scale of MODBRANCH) that yield suitable nesting conditions under present conditions might become less favorable, or unavailable for nesting due to elevated water levels during wet years due to increases in water levels simulated to occur with the with-project condition.

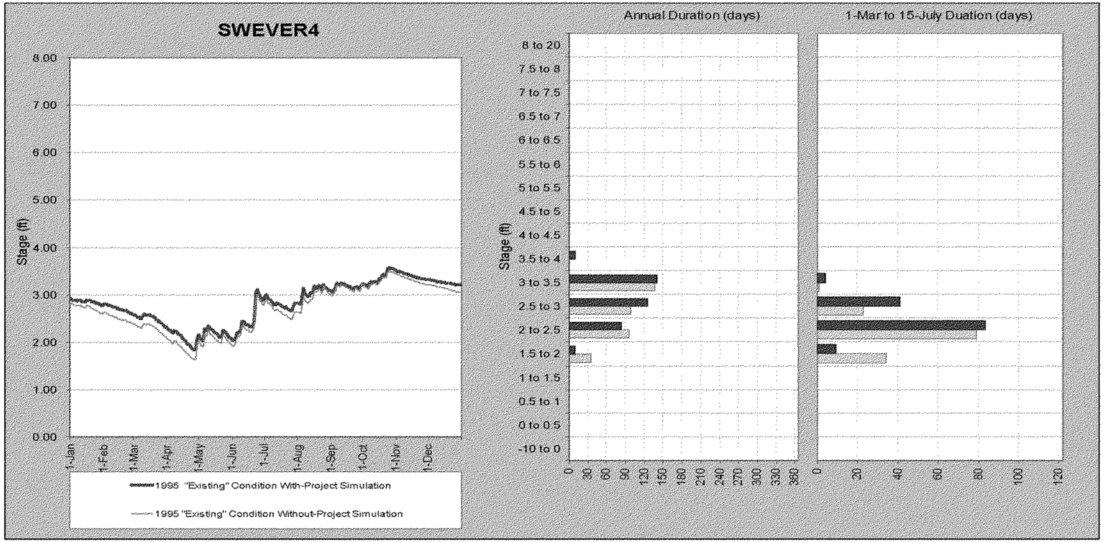

FIGURE A4-20: WET YEAR SIMULATION (SWEVER4 NEAR SUBPOPULATION D)

Stages at/near the location of SWEVER4 (subpopulation D) simulated for a wet year for the with-project condition are generally similar to those simulated for the without-project condition during the year and window for peak nesting activity. However, while the elevation of the model cell corresponding to the area near SWEVER4 is 2.8 ft NGVD, it seems likely that some local patches of habitat at lower elevations (due to topographic relief beyond the scale of MODBRANCH) that yield suitable nesting conditions under present conditions might become less favorable, or unavailable for nesting due to elevated water levels during wet years due to increases in water levels simulated to occur with the with-project condition

A.4.6.4.1 Species Effect Determination

If a species is listed or critical habitat designated within the influence of a federal action, section 7(a)(2) of the Endangered Species Act requires federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of an endangered species or adversely modify its critical habitat.

Since the proposed project potentially raises groundwater levels in sensitive areas, hydrological changes associated with implementation of the project are expected to alter some of the physical and biological features essential to the nesting success and overall conservation of the subspecies. Although the project related hydrological changes are expected to be minimal, and not likely to jeopardize the continued existence of the sub-species, the USACE has determined the project may affect and is likely to adversely affect the CSSS. Implementation of a coordinated adaptive management plan incorporating real-time ground monitoring, as outlined in the CSSS section of the project level ecological monitoring plan (***ANNEX E***), could minimize potential adverse effects to the subspecies.

A.4.6.4.2 Cape Sable Seaside Sparrow Critical Habitat

Critical habitat for the CSSS was designated in 1977; the habitat areas are grouped into units which are displayed in ***FIGURE A4-11***. An important area west of Shark River Slough, which until 1993 supported one of two core subpopulations, is not included within critical habitat designation, and has undergone detrimental changes in habitat structure as a result of previous water management practices. Additionally, other parts of the designated critical habitat have been converted to agriculture, and are no longer occupied by the sub-species.

In evaluating project impacts to designated critical habitat for the CSSS, potential adverse modifications to the primary constituent elements were examined using a hydrological model (MODBRANCH) for a comparison of existing and future with-project scenarios. The existing MODBRANCH model was developed to simulate three individual years intended to be representative of average (1978), dry (1989), and wet (1995) conditions. As such, the evaluations are limited to comparisons of existing conditions against with-project conditions for each of the referenced single-year simulations within/near critical habitat for the CSSS.

In order to predict the project related effects on the CSSS, one must consider those physical and biological features that are essential to the conservation of the species, and their habitat. These include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing (or development) of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. These requirements, which are based on the biological needs of this species, are described in proposed critical habitat designation published in the Federal Register on 6 November 2007 (FR Vol. 72, No. 214).

Primary constituent elements are physical and biological features that have been identified as elements essential to the conservation of the species. As described in the Federal Register (FR Vol. 72, No. 214), the primary constituent elements include:

1. Soils that are widespread in the Everglades' short-hydroperiod marshes and support the vegetation types that the CSSS rely on;
2. Plant species that are characteristic of CSSS habitat in a variety of hydrologic conditions that provide structure sufficient to support CSSS nests, and that comprise the substrate that CSSS utilize when there is standing water;
3. Contiguous open habitat because CSSS require large, expansive, contiguous habitat patches with sparse woody shrubs or trees;
4. Hydrologic conditions that would prevent flooding sparrow nests, maintain hospitable conditions for CSSS occupying these areas, and generally support the vegetation species that are essential to CSSS; and
5. Overall the habitat features that support the invertebrate prey base the sparrows rely on and the variability and uniqueness of habitat.

Evaluations of project effects to the primary constituent elements are discussed below:

A.4.6.4.2.1 Calcitic Marl Soils

Marl soils are characteristic of the short-hydroperiod freshwater marl prairies of the southern Everglades and support the vegetation community and which CSSS depend. Presently, soils in the marl prairie landscape within CSSS habitat vary in physical and chemical characteristics due to the variation in topography, hydrology, and vegetation (Sah et al., 2007). Alteration of soil characteristics due to project operations would be difficult to detect in the short term.

A.4.6.4.2.2 Herbaceous Vegetation

Greater than 15 percent combined cover of live and standing dead vegetation of one or more of the following species: Muhly grass (*Muhlenbergia filipes*), Florida little bluestem (*Schizachyrium rhizomatum*), blacktopped sedge (*Schoenus nigricans*), and cordgrass (*Spartina bakeri*). These plant species are largely characteristic of areas where sparrows occur. They act as cover and substrate for foraging, nesting, and normal behavior for sparrows during a variety of environmental conditions. Although many other herbaceous plant species also occur within sparrow habitat (Ross et al., 2006, pp. 10-13), and some of these may have important roles in the life history of the sparrow, the species identified in the PCE consistently occur in areas occupied by sparrows (Sah et al., 2007, p. 5). With a trend indicating longer hydroperiods affecting the vegetative community composition in CSSS critical habitats, it may be difficult to separate project level effects. In order to ensure minimal project related alterations to the existing vegetative composition necessary to sustain CSSS nesting habitat, controlled pumping to avoid ponding above a depth of 10 cm will be employed in subpopulations C and D.

A.4.6.4.2.3 Contiguous Open Habitat

Sparrow subpopulations require large, expansive, contiguous habitat patches with few or sparse woody shrubs or trees. The constituents of this PCE are largely predicated on a combination of hydroperiod and periodic fire events. Fires prevent hardwood vegetation from invading these communities and prevent the accretion of dead plant material, both of which decrease the suitability of this habitat type for Cape Sable seaside sparrows. Implementation of the proposed project could extend hydroperiods causing a minimal effect on the occurrence of natural fires in the area. The proposed adaptive management strategy, however, is designed to control excessive hydroperiods thus minimizing significant changes in vegetative composition.

A.4.6.4.2.4 Hydrologic Regime–Nesting Criteria

In order to maintain suitable vegetative composition conducive for successful nesting, it is important that water depth, as measured from the water surface down to the soil surface, does not exceed 7.9 inches (20 cm) for more than 30 days during the period from March 15 to June 30 at a frequency of more than 2 out of every 10 years. Water depths >7.9 inches (20 cm) during this period will result in elevated nest failure rates (Lockwood et al., 2001, p.278; Pimm et al., 2002, pp. 24-25). If these water depths occur for short periods during nesting season, sparrows may be able to re-nest within the same season. These depths, if they occur for sustained periods (>30 days) within sparrow nesting season, will reduce successful nesting to a level that will be insufficient to support a population if they occur more frequently than 2 out of every 10 years. Recognizing the potential for habitat alteration, pumping within the Aerojet Road Canal will cease if ponding within subpopulation D reaches a depth of 10 cm, well below the 20 cm limit as identified as the water depth threshold to ensure successful species nesting.

A.4.6.4.2.5 Potential Effects to CSSS Critical Habitat

With cooperation from the USFWS, the USACE completed a series of MODBRANCH hydrologic model runs intended to predict the hydrologic effects on the CSSS, and on the designated critical habitat within subpopulations C and D. The modeling effort was specifically intended to predict the effects on the CSSS by evaluating seasonal hydrologic changes which may have an effect on their nesting habitat, and/or year round changes which may affect the maintenance of suitable vegetative cover. Performance measures were developed to compare various hydrological parameters with existing baseline conditions against the Recommended Plan project scenario. These comparisons are summarized below in ***TABLE A4-12*** and ***TABLE A4-13***.

As a result of model interpretation, the potential effects of the proposed project should be limited to small hydrologic changes within designated critical habitat in subpopulations C and D.

TABLE A4-12: PERFORMANCE MEASURE SUMMARIES FOR CAPE SABLE SEASIDE SPARROW SUBPOPULATION C

	CSSS Habitat U2, Total number of acres = 8304						
	Simulation:	**Base Avg Year**	**W/Proj Avg Year**	**Base Dry Year**	**W/Proj Dry Year**	**Base Wet Year**	**W/Proj Wet Year**
Performance Measures	**Area with 60d<HP<180d (acres)**	3228	4682	0	0	5280	4451
	Area Weighted Average HP in areas with 60-180d HP (days)	96	98			129	150
	Area with Max Continuous Dry Days > 80 days (acres)	8304	8304	8304	8304	8304	8304
	Area Weighted Average of Maximum Continuous Dry Days in the areas with > 80 days (days)	138	138	138	138	113	116
	Area Weighted Average of Maximum Continuous Dry Days in all areas (days)	138	138	138	138	113	116
	Area with Maximum Wet Depth > 20 cm equal or greater than 1 day, 15 March - 30 June (acres)	0	0	0	0	0	17
	Area with Maximum Wet Depth > 20 cm more than 30 days, 15 March - 30 June (acres)	0	0	0	0	0	0
	Area Weighted Average of Number of Days Depth > 20 cm for more than 30 days, 15 March - 30 June (days)						

TABLE A4-13: PERFORMANCE MEASURE SUMMARIES FOR CAPR SABLE SEASIDE SPARROW SUBPOPULATION D

	CSSS Habitat U3, Total number of acres = 10806						
	Simulation:	Base Avg Year	W/Proj Avg Year	Base Dry Year	W/Proj Dry Year	Base Wet Year	W/Proj Wet Year
Performance Measures	Area with 60d<HP<180d (acres)	8915	7157	57	77	2884	2254
	Area Weighted Average HP in areas with 60-180d HP (days)	124	153	89	86	151	137
	Area with Max Continuous Dry Days > 80 days (acres)	10241	10065	10806	10806	10069	9638
	Area Weighted Average of Maximum Continuous Dry Days in the areas with > 80 days (days)	132	123	138	138	112	106
	Area Weighted Average of Maximum Continuous Dry Days in all areas (days)	128	119	138	138	109	100
	Area with Maximum Wet Depth > 20 cm equal or greater than 1 day, 15 March - 30 June (acres)	11	36	0	0	164	173
	Area with Maximum Wet Depth > 20 cm more than 30 days, 15 March - 30 June (acres)	0	0	0	0	0	35.8
	Area Weighted Average of Number of Days Depth > 20 cm for more than 30 days, 15 March - 30 June (days)						33

A.4.6.4.2.6 CSSS Critical Habitat Effect Determination

A determination of an adverse modification to critical habitat is whether, through implementation of the proposed project, would designated critical habitat remain functional (or retain the current ability for the PCEs to be functionally established) to serve the intended conservation role for the species. The conservation role of the CSSS critical habitat is to support viable core area populations.

Based on an evaluation of impacts to the primary constituent elements identified as essential to the conservation of the species, implementation of the proposed project could establish hydrological changes that may alter some of the physical and biological features within designated critical habitat subpopulations C and D of the CSSS. Although anticipated modifications are not expected to appreciably diminish the value of critical habitat, the USACE has determined that the project "may affect, and is likely to adversely affect" designated critical habitat. Implementation of an adaptive management program incorporating real-time ground monitoring, as outlined in the CSSS section of the project level ecological monitoring plan (***ANNEX E***), could minimize potential modifications to critical habitat and overall effects to the sub-species.

A.4.6.5 State Listed Species

The project area contains habitat suitable for the presence, nesting and/or foraging of fourteen state-listed threatened and endangered species and thirteen species of special concern. Threatened and endangered animal species include the arctic peregrine falcon, and Florida mastiff bat, the white-crowned pigeon, least tern, piping plover, Miami black-headed snake, and the Everglades mink. Species of special concern include the roseate spoonbill, limpkin, little blue heron, reddish egret, snowy egret, tricolored heron, white ibis, brown pelican, black skimmer, mangrove rivulus, gopher tortoise, American alligator, and the Florida tree snail.

Threatened and endangered plant species include the bracted colic root, which lives in open muhly-dominated marl prairies and rocky glades; pine-pink orchid, which frequents the edges of the farm roads just above wetland elevation; the lattice-vein fern which is found occasionally in the forested wetlands; Eaton's spikemoss, and Wright's flowering fern, both found in the Frog Pond natural area; along with the Mexican vanilla plant and Schizaea tropical fern located on tree islands in the upper Southern Glades region.

While small foraging or nesting areas utilized by many of these animal species may be affected by this project, construction impacts will be minimal and temporary, and not likely to adversely affect any protected species. Successful implementation of restoring existing wetlands will increase the prey base for wading birds and overall functional capacity of affected habitats thus benefiting the species utilizing these areas. Longer hydroperiods, as result of project operations, may affect the plant species during the wet season, but the impact is expected to be short duration and not significant to the survival of the species. Overall, no adverse impacts are anticipated to state listed species as a result of this project.

A.4.6.6 Other Species Discussion

On 9 July 2007, the FWS published the final rule in the Federal Register announcing the removal of the bald eagle from the federal list of endangered and threatened wildlife. The rule became effective on 8 August 2007. However, this species remains protected under the Migratory Bird Treaty Act and the Bald Eagle Protection Act, therefore potential impacts from project activities are discussed below.

In south Florida, nests are often in the ecotone between forest and marsh or water, and are constructed in dominant or codominant living pines (*Pinus* spp.) or bald cypress (*Taxodium distichum*) (McEwan and Hirth, 1979). About ten percent of eagle nests are located in dead pine trees, while two to three percent occur in other species, such as Australian pine (*Casuarina equisetifolia*) and live oak *(Quercus virginiana*). The stature of nest trees decreases from north to south (Wood et al., 1989) and in Florida Bay eagles nest in black (*Avicennia germinans*) and red mangroves (*Rhizophora mangle*) almost exclusively (96.9 percent), half of which are snags (Curnutt and Robertson, 1994). Suitable habitat for bald eagles is any forested area with potential nesting trees that are within 1.9 miles (three kilometes) of large open water, such as borrow pits, lakes, rivers, and large canals. Due to the confirmation of nests in Florida Bay it can be surmised that habitat is conducive for bald eagle nesting and foraging within the project area.

While small areas of foraging habitat utilized by the bald eagle may be affected during construction of this project, impacts to these areas are not likely to adversely affect this protected species. Furthermore, the Florida Bay system provides foraging habitat away from proposed construction activities. The retention of water in Taylor Slough is expected to spread freshwater over a larger area of wetlands which should provide more foraging opportunities for the bald eagle. As a result, the project may affect, but would not likely adversely affect the bald eagle.

A.4.6.7 Direct Effects

The proposed C-111 SC Western project consists of components within six geographical regions that include the Frog Pond Detention Area; the Aerojet Road Canal and Pump Station; Structure S-197B; Incremental Changes at

S-18C; C-110 Plugs and Weirs; and the L-31E Plug and Weir. These regions along with areas impacted by project features are depicted in ***FIGURE A4-21***.

The presence of a system of coastal wetlands integrated by the inflow of freshwater and to varying degrees by tidal exchange is essential to the restoration of a fully functional Florida Bay ecosystem. The proposed project components would improve freshwater delivery to coastal wetlands and adjacent estuaries. Construction of the project would redistribute flow to the salt water wetlands and nearshore bay areas which are expected to result in desirable changes to salinity. Changes in salinity may affect water quality, seagrasses, and/or marine flora and fauna in the nearshore areas, although the impacts to the aquatic resources are anticipated to be beneficial. Phase 1 of the C-111 SC project would be required to meet state water standards. Project construction activities should have limited impacts to existing vegetative communities in the project area and no effect on the nearshore communities downstream of the project area.

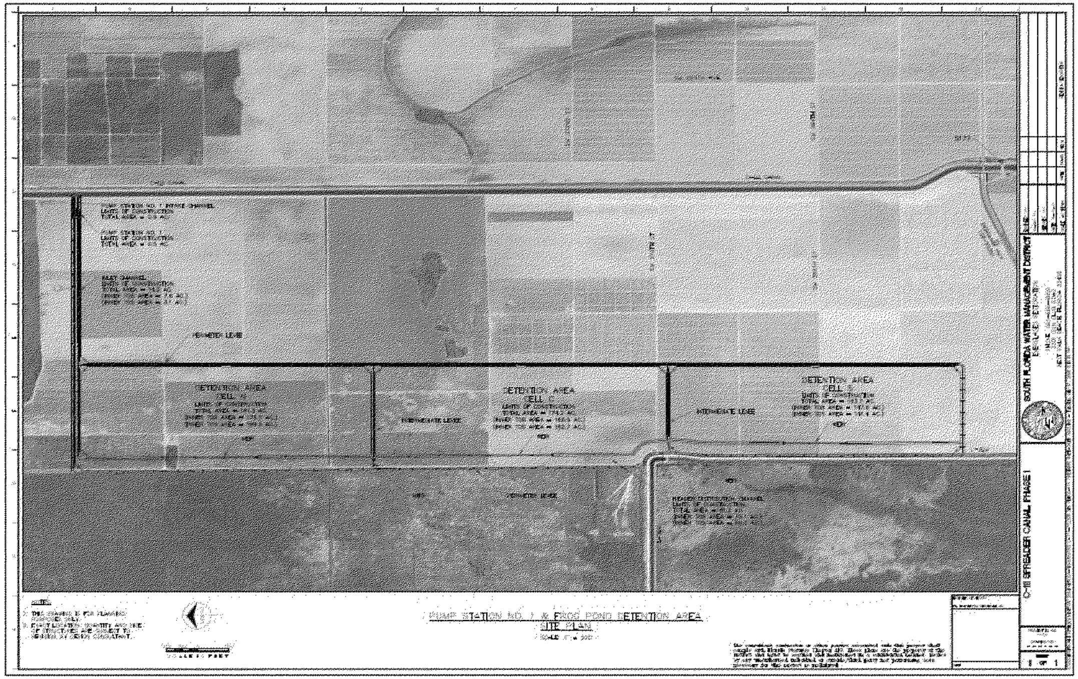

FIGURE A4-21: FROG POND DETENTION AREA SITE PLAN

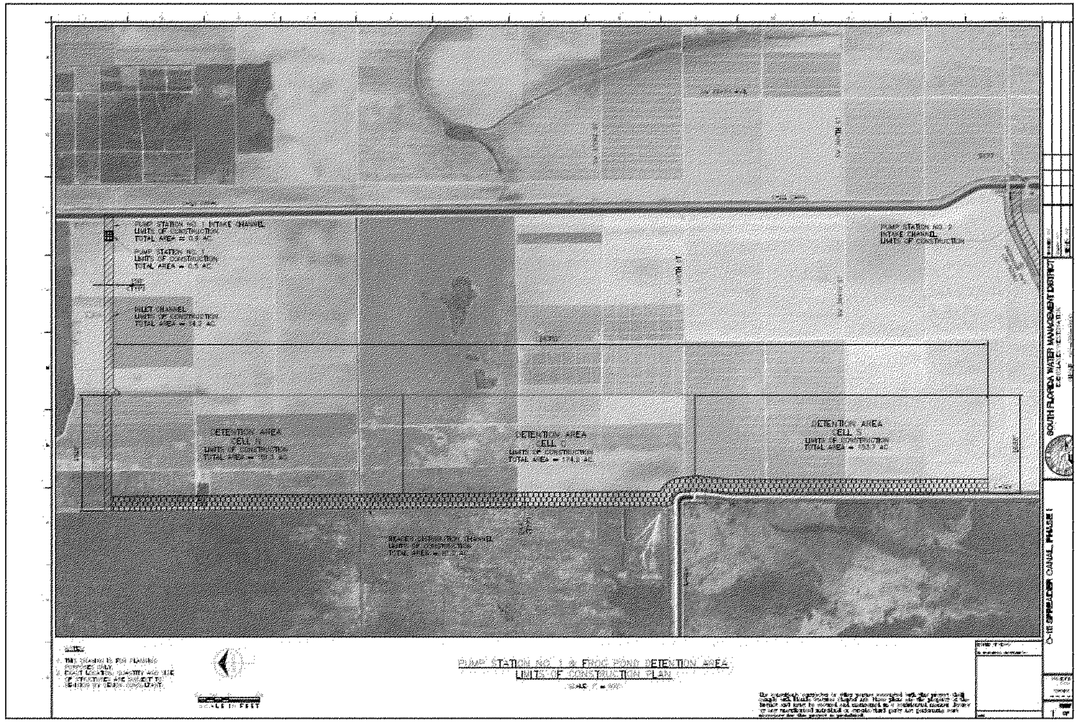

FIGURE A4-22: FROG POND CONSTRUCTION PLAN

FIGURE A4-23: AEROJET CONSTRUCTION PLAN SHEET 1

FIGURE A4-24: C-111 CANAL WATER CONTROL STRUCTURE

FIGURE A4-25: L-31E CANAL PLUG

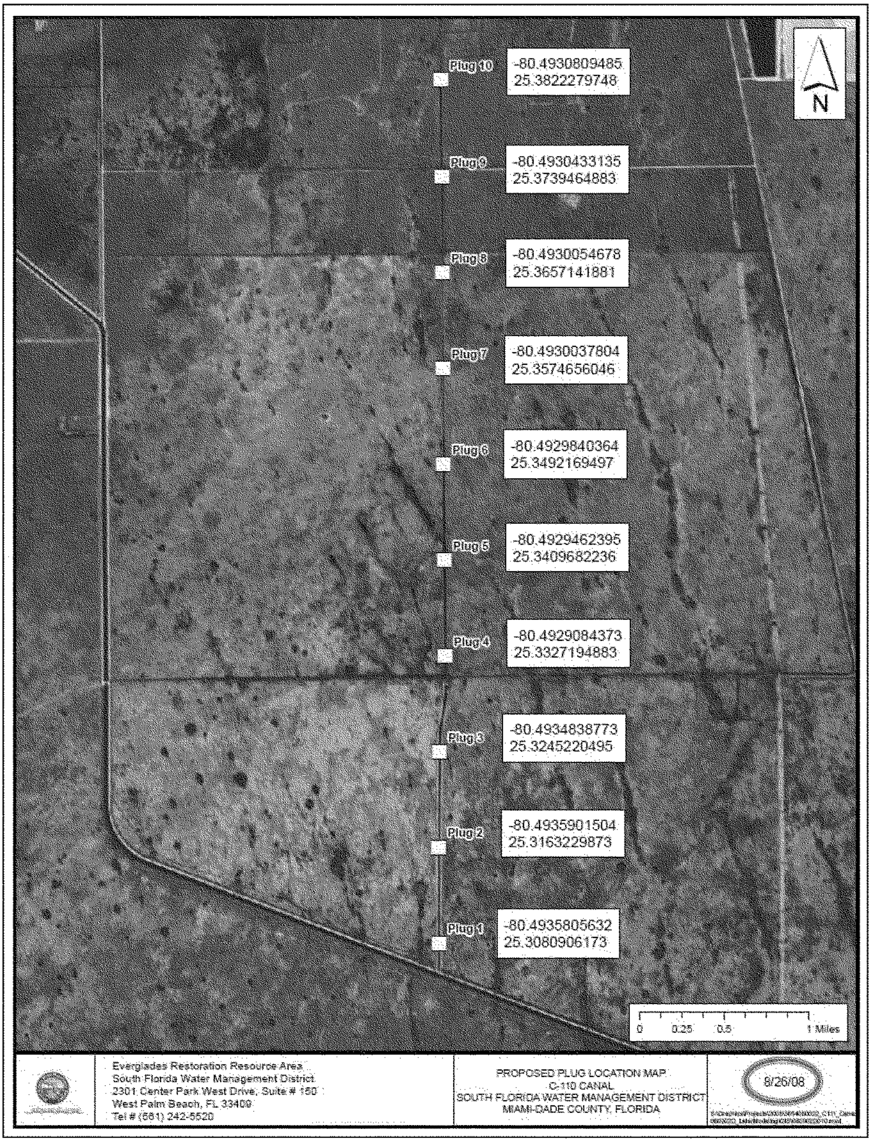

FIGURE A4-26: PROPOSED PLUGS ALONG C-110 CANAL

Within the Frog Pond Detention Area, the habitat types to be affected include sawgrass dominated freshwater wetlands. Most of this area, however, consists of agricultural fields located west of the C-111 Canal, east of Levee 31 and north of Southwest 392nd Street (County Road 9336). The majority of the 5,216-acres have been used for cultivation at this site. Current and historical crops cultivated in the area include tomatoes, beans, bananas, corn, onions, cabbage, squash, and okra. Currently, approximately 1,600 acres of the 5,216 acres is being leased out to vegetable farmers. The project benefits include water quality and the restoration of historical overland flows of freshwater through the operation of a hydraulic barrier to prevent canal seepage to the east. Restoration of overland freshwater flows will occur in Taylor Slough and will enhance existing, wetland habitat for native resources including federal and/or state listed plant and animal species. The restored hydrology will also reduce hyper saline conditions in the coastal wetlands and establish appropriate estuarine conditions which will enhance the habitat value of that system for natural resources. This project is expected to have a beneficial effect on the threatened and endangered species utilizing the affected project area.

Within the the Aerojet Road Canal, the habitat types to be affected by the operation of a pump station and bermed canal include sawgrass dominated freshwater wetlands. The project benefits include the rehydration of freshwater wetlands and the restoration of historic overland flows of water through coastal wetlands. The restoration of historic, overland water flows will be accomplished by maintaining a hydrologic barrier to prevent water seepage from Taylor Slough. The restoration of historic drainage and inundation periods is expected to enhance wetland habitat for native species including federal and/or state listed plant and animal species.

Within the lower C-111 Canal, the habitat types to be affected include sawgrass with swamp forest, graminoides with mangroves and fringe mangroves. The project benefits include the restoration of historic overland water flows and rehydration of coastal wetlands by the operation of a structure designed to reduce current levels of seepage from the lower C-111 Canal, while preserving existing levels of flood damage reduction. The rehydration and restoration of coastal wetlands will occur along the south side of the lower C-111 Canal and will enhance the wildlife habitat of adjacent coastal wetlands for native species including federal and/or state listed plant and animal species.

Within the L-31E Canal, the habitat types to be affected include graminoides with mangroves, the hypersaline ecotone, and fringe mangroves. The project benefits include the restoration of coastal wetlands by the construction of a permanent plug at S-20A, and operational changes at S-20. The proposed plug near S-20A, and proposed operational changes at S-20, specifically raising the open and close triggers 0.5 feet, are intended to more closely mimic pre-drainage hydroperiods within the Model Land. The rehydration and restoration of coastal wetlands will occur along the southeast side of the lower L-31E Canal and will enhance the wildlife habitat of adjacent coastal wetlands for native species including federal and/or state listed plant and animal species.

The project also includes backfilling and/or construction of nine earthen plugs at key locations along the C-110 Canal. The vegetation in this area consists of a mixture of sawgrass and tree islands. The project benefits of this component include the promotion of connectivity of freshwater sheet flow to mimic historic hydrological conditions within the Southern Glades. Restoration of freshwater and coastal wetlands in this area will enhance the habitat for wildlife and native plant species.

A discussion and quantification of projected impacts to the vegetative communities is summarized in ***TABLE A4-14***.

TABLE A4-14: DESCRIPTION AND QUANTIFICATION OF AFFECTED HABITATS FROM THE C-111 SPREADER CANAL WESTERN PROJECT

Affected Area	**Frog Pond Detention Area**	**Aerojet Road Canal**	**Structure 197B**
Existing Habitats	The habitat is rocky glades. Vegetation is comprised of scattered sawgrass, (*Cladium jamaicensis*), spikerush (*Eleocharis cellulosa)*, and beakrushes (*Rhmchosoera* spp.) on marl soils in association with muhly (*Mulenbergia capillaris*) praries	The habitat is rocky glades. Vegetation is comprised of scattered sawgrass, (*Cladium jamaicensis*), spikerush (*Eleocharis cellulosa)*, and beakrushes (*Rhmchosoera* spp.) on marl soils in association with muhly (*Mulenbergia capillaris*) praries	Mixture of vegetative zones that include: sawgrass with swamp forest; graminoides with mangroves; the hypersaline ecotone; and fringe mangroves
Project Features			
Pump Station	1.4 acres		
Channels	95.4 acres		
Berm		157.1 acres	
Structure			4.0 acres
Acres Displaced	**96.8 acres**	**157.1 acres**	**4.0 acres**

The features of the selected plan include pumps, canal staging, weirs, detention area, canal plugs, operational changes and structures to manage flows for optimal restoration opportunities to adjacent freshwater and saltwater wetlands. Project construction activities should have minimal adverse impacts to existing vegetative communities and no adverse effects on nearshore habitats. The existing (preconstruction) vegetative types include rocky glades; sawgrass with tree islands; muhly praries, sawgrass with swamp forest; graminoids, with mangroves; and fringe mangroves; and exotic vegetation such as Brazilian pepper and Australian pine.

The direct effects of this project to existing vegetative communities include the displacement of approximately 257.9 acres for project construction of pump structures and associated pump stations; inlet and header distribution channels; and a small berm. Despite the direct removal of wetland vegetation, this project will compensate the loss with the restoration and rehydration of approximately 17,312 acres of freshwater and coastal wetlands.

A.4.6.8 Indirect Effects

This project is expected to have a beneficial indirect effect on natural resources including threatened and endangered species due to the rehydration and overall restoration of freshwater and coastal wetland systems. This project is also expected to have a beneficial indirect effect on marine organisms associated with hard bottom communities due to the retention of freshwater in Taylor Slough and subsequent overland flow into Florida Bay which is expected to stabilize water quality and salinities required to improve and sustain the nearshore biological communities. Seagrasses are expected to benefit from the re-direction and dispersion of fresh water across the wetland systems prior to entering the Bay. This could have a beneficial effect on sea turtles known to feed on seagrasses and/or benthic invertebrates in the project area.

The Frog Pond Detention Area and Aerojet Road Canal components will ultimately improve water quality in Florida Bay and preventing seepage into the canal system and by retaining the freshwater flows across freshwater and coastal wetlands through Taylor Slough. The freshwater wetland system consists of a sawgrass, muhly grass wetland transitioning into a mixed graminoid wetland, and then a red-mangrove dominated coastal wetland system before reaching Florida Bay.

By reducing seepage from the lower C-111 Canal, the proposed operational structure in C-111 and the plug near S-20A will allow an increased volume of freshwater delivered into the coastal wetlands that would also provide indirect benefits in reducing salinities; restricting the advancement of salt water intrusion, and allow more opportunities for improved water quality.

A.4.6.9 Contaminated Soils

A Phase I Environmental Site Assessment recently conducted in the Frog Pond Property identified several pesticides and metals in soil samples. Contaminants exceeding established threshold and/or probable effects concentration include DDE, DDT, total chlordane, endosulfan, chromium, zinc, barium, and lead. Extensive copper contamination was also identified in concentrations that could adversely affect the endangered Everglade snail kite.

A pilot test has been recommended to determine if contaminated soils can be effectively removed from the rocky limestone soils within the Frog Pond property. If successful, excavated soils would be used on-site for the construction of berms, levies, or roads.

Coordination with the FWS has been initiated and will continue throughout the remediation process to insure Soil Cleanup Target Levels are achieved.

A.4.6.10 Interrelated and Interdependent Actions

The Frog Pond Detention Area and Aerojet Road Canal components work in tandem to provide a hydrologic barrier to reduce canal seepage while the operational structure and canal plug components work independent of each other. However, each individual overall goal is similar in that the projects propose to ultimately restore the historic overland sheet flow through the wetland systems in the project area. The more natural water flow would improve the ecology of Florida Bay including adjacent freshwater and tidal wetlands, nearshore bay habitat, estuarine nursery habitat, as well as water quality enhancement. Each component contributes to help improve water quality and distribution into Florida Bay.

A.4.6.11 Potential Incidental Take Resulting from Project Activities

Due to the limited direct adverse impacts to Taylor Slough and the downstream estuaries, along with no planned in-water construction, no incidental take of any species is expected in those areas. However, with potential increased hydroperiods in Unit 3 (subpopulation D) of designated critical habitat for the CSSS, incidental take of that species is anticipated.

A.4.6.12 Cumulative Effects of State and Private Actions in the Project Area

Human activities which may have had direct effects on the current condition of the plant communities are primarily those which altered the region's hydrology. Some of those were: (1) the establishment of the railroad bed along the current U.S. Highway 1 in 1904; (2) dredge and fill operations involved with construction of the Ingraham Highway, Card Sound Road, and the current ENP road system;

(3) the establishment and management of the canals and structures associated with the ENP– (South Dade Conveyance system) beginning in 1948; (4) modifications associated with the Turkey Point Power Plant in the 1960s and 1970s; and (5) flood protection associated with agriculture and more recently, residential, commercial, and recreational development in the southern Biscayne Bay watershed (Meeder et al., 1996).

As development increases in the Miami-Dade and Monroe areas, it is anticipated that the loss of functional value of the wetland and estuarine habitats will continue to decline. As the freshwater from Taylor Slough seeps eastwards into the C-111 Canal, flows are reduced causing hypersaline conditions in the downstream estuaries. Additionally, discharges into Manatee Bay and Barnes Sound via the C-111 Canal and S-197 structure, the productivity and health of the submerged aquatic vegetation decreases.

A.4.6.13 Cumulative Effects of Proposed Action

As outlined in the project objectives, the project features are designed to enhance or restore wetland and nearshore bay habitat functions by improving the quantity, timing, and distribution of water delivered to Eastern Florida Bay via Taylor Slough which would result in rehydrating adjacent coastal wetlands, and restoring the historical overland flows of freshwater.

Within the Frog Pond Detention Area and the Aerojet Road Canal, the project benefits include water quality improvements and the restoration of historical overland flows of freshwater through the operation of a hydraulic barrier preventing canal seepage to the east. The cumulative benefits of retaining freshwater in Taylor Slough could be obtained by providing higher valued wetland habitat for wildlife resources including federal and state listed plant and animal species.

The project benefits of the operational structures in the C-111 and L-31E canals include the restoration of historic overland water flows and rehydration of coastal wetlands. The restored hydrology would increase the periodic inundation of the downstream mangrove wetlands. Cumulative benefits would be obtained by enhancing the habitat value of that system for fish and wildlife resources including federal and/or state listed plant and animal species.

A.4.7 CONSERVATION MEASURES

The USACE acknowledges the potential usage and occurrence of the previously discussed threatened and endangered species and/or critical habitat within the C-111 SC Western project boundaries. In recognition of this, disturbance to listed species will be minimized or avoided by limiting construction and other disturbances during critical times. In addition, pumping in the Frog Pond

Detention Area and/or the Aerojet Road Canal will cease if ponding at a representative site within CSSS subpopulations C or D reaches a depth of ten centimeters.

This project will follow the Sea Turtle and Smalltooth Sawfish Construction Conditions dated March 23, 2006. The USACE also proposes to implement habitat management guidelines for the wood stork, construction protection measures for the American crocodile, and the standard manatee, indigo snake, and shorebird protection measures established by the State of Florida FWC, the Audubon Society, and the FWS.

A.4.8 CONCLUSION

The USACE, Jacksonville District acknowledges the probable existence of twenty-two federally listed threatened and endangered species within the boundaries of the C-111 SC Western Project. Based on available information, it is evident that the American crocodile, American alligator, West Indian manatee, Florida panther, smalltooth sawfish, wood stork, Eastern indigo snake, the Schaus swallowtail butterfly, Cape Sable seaside sparrow, the green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's Ridley sea turtle, the loggerhead sea turtle, the crenulated lead plant, Garber's spurge, and tiny polygala, resides, travels, and/or forages within the project area and could be affected by future operations of the project.

Other federally threatened or endangered species that are known to exist or potentially exist within close proximity of the project area, but which would not likely be of concern in this study due to the lack of suitable habitat include, Everglade snail kite, roseate tern, elkhorn coral, and staghorn coral. Potential impacts from project activities to state-listed endangered, threatened, or species of special concern would be minimal and temporary, and not likely to adversely affect any protected species.

As a result of the implementation of the conservation measures identified herein, it is the determination of the USACE that the proposed project may affect, but would not likely adversely affect the American crocodile, American alligator, West Indian manatee, Florida panther, smalltooth sawfish, wood stork, Eeastern indigo snake, the Schaus swallowtail butterfly, the green sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, the loggerhead sea turtle, the crenulated lead plant, Garber's spurge, and tiny polygala.

The USACE also determines that due to the lack of suitable habitat, implementation of the proposed project will have no adverse effects to the Everglades snail kite, roseate tern, elkhorn coral, and staghorn coral

The USACE further determines that implementation of the proposed project could establish hydrological changes that would alter some of the physical and biological features within designated critical habitat Units 2 and 3 (subpopulations C and D) of the CSSS. These changes could adversely affect the habitat and conditions suitable for successful nesting of the CSSS that ultimately "may affect, and is likely to adversely affect" both critical habitat and the subspecies. Implementation of an adaptive management program incorporating real-time ground monitoring, as outlined in the CSSS section of the project level ecological monitoring plan (***ANNEX E***), could minimize potential modifications to critical habitat and overall effects to the sub-species.

The USACE will continue discussions with the FWS, NMFS and the FWC in the event of project design or operational modifications. This document is being submitted for formal consultation with the FWS and NMFS pursuant to Section 7 of the Endangered Species Act.

A.4.9 LIST OF PREPARERS

Coordination and contacts were made with the following people during preparation of this Biological Assessment for the Western PIR of the C-111 SC project.

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APPENDIX 1: STANDARD PROTECTION MEASURES

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-foot radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006

A.5 FISH AND WILDLIFE SERVICE FINAL BIOLOGICAL OPINION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

August 25, 2009

Colonel Al Pantano
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service Consultation Code:	41420-2008-SL-0682
Date Received:	April 22 2009
Formal Consultation Initiation Date:	April 22 2009
Project:	C-111 Spreader Canal Western, Phase 1

Dear Colonel Pantano:

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion for the C-111 Spreader Canal (SC), Western Phase 1 Project (hereafter referred to as the C-111 SC Project), and its potential effects on the Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) and designated Cape Sable seaside sparrow critical habitat, in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). The project site is located within the C-111 Basin just east of Everglades National Park (ENP) in southern Miami-Dade County, Florida (Figure 1).

This Biological Opinion analyzes the potential effects of construction activities and proposed operations for the C-111 SC Project. This Biological Opinion is based on information and the proposed action as described and analyzed in the U.S. Army Corps of Engineers' (Corps) Draft Integrated Project Implementation Report (PIR) and Environmental Impact Statement (EIS) dated April 2009, the Revised Biological Assessment included in Annex A of that report, the C-111 SC Western Project Final EIS dated July 15, 2009, meetings, telephone conversations, email, and other sources of information. This Biological Opinion will serve to function as the response for two proposed Federal actions: (1) the Corps' implementation of the Federal civil works project described in the Draft PIR/EIS for the C-111 SC Western Project, and (2) the Corps' regulatory decision on the District's permit application for the C-111 SC Western Project as described in the final July 15, 2009, regulatory EIS. Upon issuance of any regulatory permit, the District will be the party responsible for implementation of the terms and conditions of this biological opinion. If the Federal C-111 SC Project is authorized and a Project Partnership Agreement is executed, the Corps and the District will be the responsible parties. In either consultation process, the responsible party, who is referred to as the applicant in this Biological Opinion, will be required to adhere to the terms and conditions as set forth.

A complete administrative record of this consultation is on file at the Service's South Florida Ecological Services Office in Vero Beach, Florida.

The Corps has determined that the proposed project will have "no effect" on the endangered Everglade snail kite (*Rostrhamus sociabilis plumbeus*) or its critical habitat, the threatened roseate tern (*Sterna dougallii dougallii*), the threatened elkhorn coral (*Acropora palmata*), and the threatened staghorn coral (*Acropora cervicornis*). The Corps has also determined that the proposed project "may affect, but is not likely to adversely affect" the endangered Florida panther (*Puma* [=*Felis*] *concolor coryi*), endangered West Indian manatee (*Trichechus manatus*) or its designated critical habitat, endangered wood stork (*Mycteria americana*), endangered crenulate lead-plant (*Amorpha crenulata*), endangered tiny polygala (*Polygala smallii*), threatened American crocodile (*Crocodylus acutus*) or its critical habitat, threatened eastern indigo snake (*Drymarchon corais couperi*), threatened Schaus swallowtail butterfly (*Heraclides aristodemus ponceanus*), and threatened Garber's spurge (*Chamaesyce garberii*). The bald eagle is no longer a federally listed species under the Act (71 Federal Register [FR] 8238). Therefore, there is no requirement under the Act to consult on potential impacts to the bald eagle. However, the bald eagle continues to be protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The Corps has also determined that the proposed project "may affect, and is likely to adversely affect" the endangered Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*). The Corps determined that the project "will affect" designated Cape Sable seaside sparrow critical habitat; the Service assumes this is a "may affect, likely to adversely affect" determination.

The Service concurs with the Corps' determination of "may affect, not likely to adversely affect" for the following species:

Florida Panther

The C-111 SC study area is within the designated Primary Zone of the Panther Focus Area (Figure 2) (Service 2006a). An analysis of Florida panther radio-telemetry data has shown considerable panther activity within the C-111 SC Project study area (Figures 3 and 4) and with respect to land cover reveals that panthers prefer forested cover types as daytime rest sites. They also utilize other natural and disturbed cover types for feeding, breeding, and sheltering, as long as patches of forest with understory are present in the landscape. The habitat types located within the project study area include flooded woody vegetation, mixed shrubs, freshwater marsh, sawgrass marsh, hardwood hammocks (tree islands), and areas with exotic vegetation which are occasionally used by Florida panthers. Levee areas may also be used by Florida panthers (Service 1999).

The Florida Panther Habitat Preservation Plan (Logan et al. 1993) identified the Model Lands Basin within the C-111 SC Project area, located south of the urban area of Florida City and east of U.S. Highway 1, as important panther habitat that would provide connectivity between ENP, Crocodile Lake National Wildlife Refuge, the Southern Glades Wildlife and Environmental Area, and Biscayne National Park. Two relatively recent panther mortalities along the western edge of the Model Lands provide evidence that the project site may occasionally be used by dispersing panthers. Panther UCFP80 was killed by a motor vehicle on Card Sound Road on

February 2, 2006, and panther UCFP96 was killed by a vehicle on U.S. Highway 1 just south of Card Sound Road on May 9, 2007. The Florida Fish and Wildlife Conservation Commission (FWC) telemetry data indicates that panther #21 utilized a large portion of the Model Lands Basin between the Florida Power and Light's (FPL) Turkey Point Power Plant cooling canals and Card Sound Road in 1988. No denning sites have been documented within the project study area.

The project footprint of the Frog Pond Infiltration Basin contains 530 acres of marginal quality panther habitat located within the eastern edge of the primary zone in ENP. The quality of the habitat has been diminished primarily by agricultural land use but also encroachment of exotic vegetation, and its proximity to the urban boundary. This represents the largest contiguous habitat area in terms of acreage that will be affected by the project. This area consists of leveled and rock-plowed bare fallow agricultural fields with documented contaminants for which remediation will be performed as part of project implementation. This area offers little habitat value to panthers. It will be replaced by the Frog Pond Infiltration Basin from which contaminated soils will be scraped to underlying rock and encased in the levee that will be constructed to impound the feature. The operation of the infiltration basin will result in up to 90 acres of the infiltration basin being inundated for 80 days or longer at an average depth of 1 foot in an average year. These conditions could sustain a short hydroperiod wetland vegetation community. The remainder of the basin and levee would be covered with a dry grassy vegetation cover type. For the Florida panther, this resultant conversion of habitat types will not result in a change in habitat quality since the current and anticipated habitat types are both classified as marginal quality habitat. Enclosure 1 provides the Service's current habitat assessment methodology for the Florida panther that is the basis for this determination. Based on the methodology outlined, the most appropriate habitat classification of the Frog Pond Infiltration Basin would be a Stormwater Treatment Area (STA). The attached panther habitat assessment methodology outlines that STAs converted from existing agriculture land use (cropland ranking value 4.8) would be evaluated as if the agriculture land use was converted to improved pasture (ranking value 5.2) for the berms, and wet prairie/marsh (ranking value 4.7) and dry prairie (ranking value 6.3) for the infiltration basin impoundment floor with no net decrease in habitat value to the panther.

All other areas in the project study area, such as flooded woody vegetation, marl prairie, sawgrass (*Cladium jamaicense*), tree islands, slough, mangrove fringe, and upland (agriculture, urban, roads and levee) areas affected by project features will retain their current value to panthers upon project construction and implementation. Construction of plugs across canals on the Aerojet, C-110, and L-31E canals may be beneficial to panthers and their prey in terms of partially reestablishing continuity of habitat that has been fragmented by the construction of the canals. The berms around the Frog Pond Infiltration Basin and plugs will provide potential panther hunting habitat and provide corridors for traveling.

Potential effects of the action include an increased risk of roadway mortality to panthers traversing the area and an increase in noise disturbance to panthers in the project vicinity due to construction activities. No additional roadways will be constructed as a result of this action. However, project construction will result in increased traffic consisting of heavy equipment and employee vehicles. The applicant has agreed to incorporate signs and speed limits for vehicles entering in and traversing through the project boundaries and warning signs and lights if work is to be conducted at night. All vehicles will be required to obey posted speed limits for off road and for improved road travel. The Service believes this will reduce the risk of panther/vehicle collisions. Further, impacts associated with construction traffic will be localized due to construction occurring in phases, such that panthers can avoid the area under construction. Additionally, all entrances will be secured with gates to control unauthorized vehicle access. Noise levels would be localized as the phases are under construction. Thus, adverse impacts to panthers are not anticipated. The Service concurs with the Corps' determination of "may affect, not likely to adversely affect" the Florida panther for the construction and operation of the proposed C-111 SC Project.

No critical habitat has been designated for the panther, therefore, none will be affected.

West Indian Manatee and its Designated Critical Habitat

West Indian manatees occur throughout Florida Bay, Barnes and Card Sounds, and all other embayments found in the C-111 SC Project study area, but are most frequently observed in tributaries and near-shore seagrass beds (Service 2001). Extensive acreages of seagrass beds in the bays provide foraging areas for manatees. Manatees also depend upon canals as a source of freshwater and as resting sites. The relatively deep waters of the canals respond more slowly to temperature fluctuations at the air-water interface than the shallow bay waters. Thus, the canal waters remain warmer than open bay waters during the passage of winter cold fronts and manatees use the deeper canals as a cold-weather refuge. The majority of documented manatee sightings have occurred in these canals, tributaries, and seagrass beds (Figure 5). Manatees are present year-round, but are most abundant in winter. The West Indian manatee has rarely been documented in the interior canal infrastructure of the project area above the coastal and estuarine tidal creek border, bays, and sounds even though these areas are accessible (Figure 6). For the entire period of record spanning over 20 years, there has been one recorded manatee within the L-31N, C-111, and L-31W canals (Figure 5).

The likelihood of a manatee occurring in the portions of the project area that will be directly affected by construction is unlikely. However, the West Indian manatee may experience periodic localized reductions in freshwater flow in the C-111 Canal below S-197 due to project operations (in an area that they have been documented to use) that may result in some localized redistribution of manatee use in estuarine coastal areas however; these are expected to be minor.

Modbranch model simulations, intended to show how much water could theoretically be diverted to reach Florida Bay through Taylor Slough, do indicate that the diversion of water into the Frog Pond Infiltration Basin and the Aerojet Canal will reduce the quantity of water released at the S-197. This is particularly true when S-197 discharges are considered excessive during high intensity precipitation events and damaging to the marine environment. It has been estimated that up to 60 percent of flow reaching Florida Bay was historically delivered by Taylor Slough, with all other sources making up the remainder (Lorenz et al. 2002; Van Lent et al. 1993, 1999). Construction of the C-111 Canal has altered that distribution such that S-197 discharges now make up a disproportionate share of the flow to Florida Bay (Lorenz et al. 2002; Van Lent et al. 1999).

Model simulations indicate that the proposed project will result in increased flows delivered through Taylor Slough to Trout Creek, Mud Creek, Taylor River, and McCormick Creek and eventually Florida Bay in the westerly portion of the basin as they did prior to construction of the C-111, while reducing the flows through West Highway Creek and the C-111 Canal. This more natural spatial distribution, which favors the westerly creeks, is due to the geographic location of the creek headwaters lying within the topographic gradient of Taylor Slough.

Under current water management practices, monthly minimum water delivery targets have been established for S-18C for environmental purposes and to control salt water intrusion in the lower C-111 Basin. During the wet season, S-18C discharges frequently exceed these minimums. With the decline in seasonal rainfall in the dry season, water is typically imported into the C-111 Basin to maintain minimum canal levels and prevent salt water intrusion. The dry season water deliveries are expected to be at least partially maintained throughout the incremental testing of higher water level controls at S-18C by groundwater leaking around the structure from the higher upstream water level controls.

The average historical recession rate at gauge station EPSW, based on the period of record November 1, 1986, to April 30, 2008, is an average monthly decrease of 0.1077 feet with a 95 percent confidence interval of -0.0175 to 0.2330 feet Should the marsh water level at the EPSW gauge appear to drop too quickly compared with the 95 percent confidence interval (approximately 0.25 feet per month) during the 6 months between November to April, and if headwater stages at S-18C allow, the C-111 SC Project Draft Project Operations Manual outlines that the District will attempt to recover the slope of the recession curve by opening one of S-18Cs two gate structures (each individual gate is 22.8 feet wide) approximately 0.5 foot or 1.0 foot above the -7.0 feet NGVD29 submerged sill elevation. The structure will remain open until the recession slope is recovered or until upstream conditions at S-18C no longer allow. This safeguard has been included to avoid harm to the wetlands of the ENP Panhandle and to the marine environment in Manatee Bay.

In summary, the project is a re-distribution project intended to meet the needs of the Florida Bay ecosystem by providing a more natural spatial distribution of freshwater inflows that should on the larger project level scale be beneficial to manatees. The Corps has agreed to implement the Comprehensive Everglades Restoration Plan (CERP) manatee guidelines during construction. These measures would further reduce the potential direct effect of construction on the manatee. Therefore, the Service concurs with the Corps' determination of "may affect, not likely to adversely affect" for the West Indian manatee.

The project study area overlaps designated critical habitat for the West Indian manatee (35 FR 8495; June 2, 1970) which includes "all waters of Card, Barnes, Blackwater, Little Blackwater, Manatee, and Buttonwood Sounds between Key Largo, Monroe County, and the mainland of Miami-Dade County." No designated critical habitat for the West Indian manatee occurs in or near the construction footprint for the project. Critical habitat could be affected by redistribution of freshwater flows in the C-111 Canal below the S-197 discussed above; however, these effects are expected to be minor. Therefore, the Service concurs with the Corps' determination of "may affect, not likely to adversely affect" for the West Indian manatee designated critical habitat for the construction and operation of the proposed C-111 SC Project.

American Crocodile and its Designated Critical Habitat

The current distribution of the American crocodile in the United States is limited to extreme southern Florida. The American crocodile is found primarily in mangrove swamps and along low-energy mangrove-lined bays, creeks, and inland swamps (Kushlan and Mazzotti 1989). During the non-nesting season crocodiles are found primarily in the fresh and brackish waters in inland swamps, creeks, and bays. During the breeding and nesting season (spring and summer) adults use the exposed shorelines of Florida Bay. Natural nesting habitat includes sites with sandy shorelines or raised marl creek banks adjacent to deep water. Crocodiles also nest on elevated man-made structures such as canals berms (Service 1999).

The American crocodile is known to range throughout southern Biscayne Bay, Card Sound, Barnes Sound, and portions of Florida Bay. Crocodiles exist in the project area mostly in ponds, canals and shorelines. Canal banks similar to the levee associated with major canals in the project area are generally suitable for nest sites, and the berms associated with the old east-west agricultural secondary canals may also be suitable for nesting. However, nesting within the project construction area has not been documented. Known nest sites are located at the cooling canals of FPL's Turkey Point Power Plant, which supports the most successful nesting population in south Florida (Mazzotti et al. 2002). These cooling canals occupy the eastern section of the Model Lands, but lie outside the project area. Crocodiles also nest at Crocodile Lake National Wildlife Refuge, which is located in the southern end of Barnes Sound, and creeks and beaches in north-east Florida Bay outside the construction area. There have also been a number of American crocodiles killed along U.S. Highway 1 and Card Sound Road over the past several years (Klett 2003).

One of the primary C-111 SC Project objectives is to restore a more natural salinity gradient to the coastal wetlands. Watershed flow through conveyance canals has created an unnaturally high salinity environment in these wetlands, which has caused a loss of graminoid marshes and a landward migration of mangrove wetlands (Ross et al. 2002; Sklar et al. 2002). Juvenile crocodiles require low salinities for growth and survival presumably because they have limited physiological capability to osmoregulate. The ideal salinity range for crocodiles is less than 20 parts per thousand (Mazzotti et al. 2002). As salinity levels increase above 20 parts per thousand, habitat suitability decreases. Redirecting freshwater from conveyance canals into the coastal wetlands may lower salinities there, which may increase suitable habitat conditions for juvenile crocodiles.

Since American crocodiles almost exclusively use the cooling canals of FPL's Turkey Point Power Plant, Crocodile Lake National Wildlife Refuge, which is located in the southern end of Barnes Sound, and creeks and beaches in north-east Florida Bay it is unlikely that they would be directly affected by activities within the project construction area. Therefore, the Service concurs with the Corps' determination of "may affect, not likely to adversely affect" for the American crocodile.

The C-111 SC Project area overlaps designated critical habitat for the American crocodile (44 FR 75076; December 18, 1979). The northern boundary of critical habitat for this species begins at the easternmost tip of Turkey Point and extends southeast and southwest across the southern part of the project area (Figure 7). Thus, the Model Lands, including the wedge area between U.S. Highway 1 and Card Sound Road, lie within critical habitat for this species.

The proposed Frog Pond Infiltration Basin, Aeroject Canal (pump station, weirs, and perimeter berming) and the C-111 SC Design Test Project (Design Test) do not occur within the designated American crocodile critical habitat (Figure 7) and therefore will have no effect on critical habitat. Features such as the Aeroject Canal plugs south of the canal intersection with L-31W, Intermediate Water Control Features (S-198), incremental S-18C changes, L-31E Canal changes (plug at S-20A, and operational changes at S-20), and C-110 Canal changes (earthen plugs) do occur within American crocodile habitat. Although these project features will not affect critical habitat detailed above that contains the majority of crocodiles, there are sporadic observations and therefore these features may have temporary effects on critical habitat during construction. These effects would be limited to earthmoving and fill operations on approximately 4 acres of critical habitat. Conversely, beneficial effects of the project may be observed in the form of increased flow and reduced salinities in northern Florida Bay and increased stage in canals and associated marshlands in crocodile critical habitat. Therefore, the Service concurs with the Corps' determination of "may affect, not like to adversely affect" for the American crocodile designated critical habitat for the construction and operation of the proposed C-111 SC Project.

Eastern Indigo Snake

Over most of its range, the eastern indigo snake frequents several habitat types, including pine flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats. Eastern indigo snakes need a mosaic of habitats to complete their annual life cycle. Interspersion of tortoise-inhabited sandhills and wetlands improves habitat quality for this species (Service 2004a). In the milder climates of central and southern Florida, eastern indigo snakes exist in a more stable thermal environment, where availability of thermal refugia may not be as critical to the snake's survival. Throughout peninsular Florida, this species may be found in all terrestrial habitats which have not experienced high density urban development. They are especially common in the hydric hammocks throughout this region (Service 1999). In central and coastal Florida, eastern indigo snakes are mainly found within many of the State's high, sandy ridges. In extreme south Florida, these snakes are typically found in pine flatwoods, pine rocklands, tropical hardwood hammocks, and in most other undeveloped areas (Service 1999). Eastern indigo snakes also use some agricultural lands (such as citrus) and various types of wetlands (Service 1999).

The eastern indigo snake may be present within and adjacent to the proposed project boundaries. Most of the potential C-111 SC study area can be considered eastern indigo snake habitat except for open water not associated with tree islands, levees, or banks and disturbed areas not associated with vegetative cover. Indigo snakes range over large areas and into various habitats throughout the year with most activity occurring in the summer and fall. The eastern indigo snake will use most of the habitat types available in its home range, but prefers open undeveloped areas. This species requires sheltered "retreats" from winter cold and desiccating conditions, such as gopher tortoise burrows, armadillo holes, crab holes, tree stumps, root masses, and debris piles. Eastern indigo snakes are known to use levees which impound water in south Florida. Because of its relatively large home range (averaging 183 acres for males and 47 acres for females), this snake is especially vulnerable to habitat loss, degradation, and fragmentation (Service 1999). Eastern indigo snakes are known to occur in the vicinity of the action area (Figure 8) and could be adversely affected by the proposed action. The Corps' commitment to implement the *Standard Construction Measures for the Eastern Indigo Snake* (Service 2004a) will provide some level of protection but not preclude the possibility that indigo snakes could occur in areas where they could accidentally be killed during construction activities. Therefore, the Service does not concur with the Corps determination of "may affect, not likely to adversely affect" for the eastern indigo snake for the construction and operation of the proposed C-111 SC Project, instead the Service has determined that the C-111 SC Project "may affect, and is likely to adversely affect" the eastern indigo snake.

No critical habitat has been designated for the eastern indigo snake; therefore, none will be affected.

Wood Stork

The wood stork is primarily associated with freshwater and estuarine habitats for nesting, roosting, and foraging. Wood storks typically construct their nests in medium to tall trees that occur in stands located either in swamps or on islands surrounded by relatively broad expanses of open water (Service 2004b). Typically, in south Florida, wood storks generally begin their breeding cycle in November through January with peak activity in December. Nestlings fledge in late April through early May. In response to deteriorating habitat conditions in south Florida, nest initiation has shifted to February and March in some areas with nestling dispersal in July through August (Service 2004b). Wood storks occur in a wide variety of wetland habitats during the non-breeding season, or while foraging. Typical foraging sites for the wood stork include freshwater marshes and stock ponds; shallow seasonally flooded roadside or agricultural ditches; narrow tidal creeks or shallow tidal pools; managed impoundments; and depressions in cypress heads and swamp sloughs (Service 1999). Because of their specialized feeding behavior, wood storks forage most effectively in shallow-water areas with highly concentrated prey (Service 2004b). In south Florida, low, dry-season water levels are often necessary to concentrate fish to densities suitable for effective foraging by wood storks (Service 2004b). As a result, wood storks will forage in many different shallow wetland depressions where fish become concentrated due to local reproduction by fishes or as a consequence of seasonal drying.

The C-111 SC study area is within the Primary and Secondary Nesting Zones for one known active wood stork colony (Service 2004b, 2009a) (Figure 9). The Lower Taylor Slough colony located on the eastern edge of Taylor Slough approximately 3 miles north-west of the north shoreline of Little Madeira Bay (Figure 10) is an active colony that contained approximately 30 nests (Service 2004b and Service 2009a). The Madeira wood stork colony that was located approximately 2 miles north-west of the north shoreline of Little Madeira Bay (Figure 10) is also located within the C-111 SC Project study area. This colony has had no documented nesting during the period from 1996 through 2009 (Service 2009a). Potential nesting habitat does exist in the study area in tropical hardwood hammock, hardwood swamp, shrub swamp, and exotic plant habitat types. Most of the project study area is within the Core Foraging Area (CFA) of documented active wood stork nesting colonies located outside the project area south of Tamiami Trail and in ENP (Figures 9 and 10). The Cuthbert Lake and Paurotis Pond colonies are located 3 to 5 miles west of the project study area boundary and their CFA could encompass a large portion of the project study area. The CFA is a 30-kilomenters (18.6-meters) zone surrounding the colony boundary. These colonies have had documented nesting activity during the period from 1996 through 2008 (Service 2008a).

The construction and operation of the C-111 SC Project will not reduce the area, depth, or length of flooding in wetlands under (primary zone) and surrounding (secondary zone) the Lower Taylor Slough wood stork colony. The construction and operation of the C-111 SC Project will have little to no overall measurable affect on prey production or foraging conditions within the foraging radius of the active colony within the project study area and nearby wood stork colonies. The proposed action will not alter water levels during the nesting season under the nesting substrate in any active colony in such a way that would result in an artificial reversal or cause a reduction in wood stork foraging conditions in areas near the colony significant enough to cause colony abandonment. Anticipated project effects, based on model output, indicate that there will be benefits to wood stork and other wading bird prey production based on the extended hydroperiod and increased flows expected in some areas of the project study area. This was described in further detail in the Service's Coordination Act Report for the C-111 SC Project (Service 2009b). The Service conducted an analysis based on model output of wading bird habitat in the project study area that integrated the project effect on optimal foraging depth and the optimal water recession rate to concentrate prey species resulting in a calculation of the project's effect on wading bird habitat units (Service 2009b). The summary results of this analysis for an average year are illustrated in Table 2. This analysis shows the overall project effect on potential wood stork foraging habitat to be varied throughout the study area with improvements in many areas. Some negative project effects on wading birds are indicated in this analysis but they occur prior to January the beginning of the period when wood storks currently initiate nesting and in Taylor Slough only in the wet year (1995). Therefore, the Service concurs with the Corps' determination of "may affect, not likely to adversely affect" for the construction and operation of the proposed C-111 SC Project to the wood stork.

No critical habitat is designated for the wood stork; therefore, none will be affected.

Schaus Swallowtail Butterfly

The present distribution of the Schaus swallowtail butterfly extends from southern Miami-Dade County through the Keys in Biscayne Bay and north to southern Key Largo in the Upper Keys, to Lower Matecumbe Key in the Middle Keys. The Schaus swallowtail butterfly occurs exclusively in subtropical dry forests (hardwood hammocks) including areas that were formerly cleared and farmed, but have since regrown (Service 1999). The Service concurs with the Corps' determination of "may affect, not likely to adversely affect" for the Schaus swallowtail butterfly because the location of preferred subtropical dry forest habitats of this species will not be impacted by construction or operation of the C-111 SC Project.

Garber's Spurge

Garber's spurge is a short-lived, perennial herb belonging to the Euphorbiaceae or spurge family. This species is known from pine rocklands, coastal flats, coastal grasslands, and beach ridges in Miami-Dade and Monroe Counties, Florida. It requires open sunny areas and needs periodic fires to maintain habitat suitability. The Service concurs with the Corps' determination of "may affect, not likely to adversely affect" for the Garber's spurge because the preferred upland and coastal habitats of this species will not be impacted by construction or operation of the C-111 SC Project.

Tiny Polygala

Tiny polygala is in the family Polygalaceae, commonly referred to as the milkworts. The tiny polygala or Small's milkwort is a short-lived herb. The only known populations occur in sand pockets of pine rocklands, open sand pine scrub, slash pine, high pine, and well-drained coastal spoil (Service 1999). It was once thought to be endemic to Miami-Dade and Broward Counties, but recent surveys have extended its range to southern St. Lucie County. It is now known to occur on the Atlantic Coastal Ridge of southeast Florida, from the Perrine area of Miami-Dade County north to southeast St. Lucie County. All 11 known populations are found within 9.7 kilometers of the Atlantic coast. The Service concurs with the Corps' determination of "may affect, not likely to adversely affect" for the tiny polygala because the preferred habitats and locations of this species will not be impacted by construction or operation activities of the C-111 SC Project.

Crenulate Lead-Plant

The crenulate lead-plant is a perennial, deciduous shrub that inhabits marl prairies and wet pine rocklands in a small area of Miami-Dade County. This pine rockland community is maintained by periodic fires. The crenulate lead-plant is known from a 20 square-mile area from Coral Gables to Kendall, Miami-Dade County (Service 1999). The Service concurs with the Corps' determination of "may affect, not likely to adversely affect" for the crenulate lead-plant because the location of the preferred marl prairies and wet pine rocklands habitats of this species will not be impacted by construction or operation activities of the C-111 SC Project.

Consultation History

On December 16, 2002, the Service sent a planning aid letter (PAL) to the Corps providing the Service's comments with regard to the Corps' May 7, 2002, Public Notice soliciting input on issues to be considered as the Corps developed its National Environmental Policy Act analysis of the C-111 SC Project.

On September 9, 2003, the Service submitted performance measures to the C-111 SC Project Delivery Team (PDT) for evaluation of project effects on wading birds, Cape Sable seaside sparrow, eastern indigo snake, Florida panther, West Indian manatee, periphyton, American alligator (*Alligator mississippiensis*), and American crocodile.

On September 30, 2003, the Service sent a PAL to the Corps providing a summary of the Service's current assessment of the effects of the footprint of the project to species listed under the Act and their designated critical habitat.

On October 31, 2003, the Service submitted revised performance measures to the Corps following PDT and WASH123 modeling team review and provided further comments on the evaluation of project effects on wading birds, Cape Sable seaside sparrow, West Indian manatee, Florida panther, periphyton, exotics, aquatic fauna, American alligator, and American crocodile.

On February 12, 2004, the Service transmitted a letter to the Corps in response to the Corps' request for a list of threatened and endangered species and critical habitats that may occur within the C-111 SC study area, concurring with the list of species provided by the Corps, and listing additional species and critical habitat that should be included in the consultation.

On March 22, 2004, the Service, PDT, and WASH123 (the Corps hydrologic model being considered for use at that time) modeling team participated in a teleconference coordinating evaluation criteria and model post-processing that would be needed to evaluate project effects.

On June 13, 2004, the Service submitted draft objectives and a methodology for wetland and forested habitat assessment to the project ecological sub-team, for use in baseline and post construction monitoring.

On August 12, 2004, the Service transmitted comments to the Corps in a PAL for the C-111 SC Project introducing the wetland quality assessment methodology and its possible use for project monitoring and responding to PDT questions about methodology, and recommending future steps to complete the project assessment.

On December 29, 2004, the Service participated in a C-111 SC aerial helicopter field reconnaissance to delineate and update data relating to current vegetative ecological zones in the project study area.

On March 24, 2005, the Service sent a PAL to the Corps submitting the future without project condition, wildlife and environmental section for the Feasibility Scoping Meeting documentation.

On August 25, 2005, the Service submitted Evaluation Criteria 3.3: Cape Sable Seaside Sparrow Nesting Condition Availability and Evaluation Criteria 3.2: Wading Bird Recession Rate and Foraging Habitat performance measures to the project PDT to be used as part of project alternatives evaluation.

On September 1, 2005, the Service submitted Cape Sable Seaside Sparrow Nesting Condition Availability and Wading Bird Recession Rate and Foraging Habitat performance measures post processing instructions to the Corps' modelers to be used as part of project alternatives evaluation using the WASH123 model.

On November 22, 2005, the Service sent a PAL to the Corps providing the Service's recommendations to include a number of fish and wildlife enhancement features in the design and operation of the C-111 SC STA or reservoir.

On January 20, 2006, the Service transmitted comments to the Corps in a PAL for the C-111 SC Project recommending that the north alignment of the spreader canal appeared to provide the most restoration benefits to the project among the suite of alternatives. Additionally, the Service also recommended that given the cursory nature of the alternatives analysis, a more comprehensive look be taken at the full array of alignments, including options to adjust any specific alignment from its currently projected location, opportunities to reduce costs by maximizing use of public lands, and possibly even shortening the spreader canal.

On May 24, 2006, the Service provided comments to the District through the Dr Checks database on the C-111 SC Project Basis of Design Report prepared by the District's contractor.

On June 27, 2006, the Service provided comments in response to the District back check comments through the Dr Checks database on the District's C-111 SC Project Basis of Design Report.

On July 24, 2006, the Service provided recommendations for corrections in habitat areas delineated for threatened and endangered species delineated in the C-111 SC Project Basis of Design Report.

On August 15, 2007, Service biologists, the project biologist from Miami-Dade Department of Environmental Resources Management and members of the Habitat Evaluation Procedure development team conducted baseline field sampling of aquatic invertebrate abundance and quality in project areas anticipated to be impacted by alternatives.

On December 28, 2007, the Service sent a letter to the Corps in response to their invitation to be a cooperating agency as part of the preparation of the C-111 SC Project EIS.

On April 29 and 30, 2008, Service biologists, PDT members, and Cape Sable seaside sparrow researchers conducted a field survey of characteristics of habitat areas in subpopulation D to investigate the relationship of currently utilized habitat conditions to those outlined as Primary

Constituent Elements (PCE) documented in the final critical habitat designation for the Cape Sable seaside sparrow on November 6, 2007 (50 FR 62736).

On March 16, 2009, the Service provided the Corps with the Draft FWCAR and solicited comments from the FWC and National Marine Fisheries Service as well as the National Park Service.

On July 30, 2009, the Service provided the Corps with the Final FWCAR.

On August 11, 2009 the Service facilitated a meeting with the Corps, District, and the Florida Department of Environmental Protection to discuss draft conclusions and terms and conditions to be included in the Service's Biological Opinion on the C-111 SC Project.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The project objectives for the C-111 SC Western Phase 1 Project are listed below:

- Restore the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough to historic levels as derived from the pre-drainage model runs.
- Improve hydroperiods and hydropatterns in the Southern Glades and Model Lands. The hydroperiods will be improved to optimal levels to support historical vegetation patterns as derived from the pre-drainage model runs. Hydropatterns will be restored to historical sloughs and associated tributaries.
- Return coastal zone salinities to historical recorded conditions through the redistribution of water that is currently discharged to tide.

The Recommended Plan for the C-111 SC Phase 1 (Western) Project includes the features associated with Alternative 2DShort (Figure 11). The Recommended Plan provides opportunities to reduce the decision-critical uncertainties needed to recommend a full-scale spreader canal, and other C-111 SC Phase 2 (Eastern) features. The Recommended Plan (Alternative 2DShort) is intended to improve the quantity, timing, and distribution of water delivered to Central Florida Bay via Taylor Slough. It is anticipated that these improvements can be realized through the establishment of a hydraulic ridge between Taylor Slough and the C-111 Canal, to reduce seepage loss from Taylor Slough, and its headwaters. The focus of this plan is to: (1) evaluate system-wide responses; (2) evaluate critical project uncertainties to changes in the intended reduction of seepage losses from Taylor Slough; (3) record ecological responses to these changes; and (4) evaluate the resulting flood control responses of the drainage system. Information gained from this restoration effort will provide valuable information for the planning and design of a spreader canal system to replace the existing C-111 Canal.

The hydraulic ridge will be established by combining operational changes within the lower C-111 Canal (south of S-177), the diversion of water that is currently being discharged through S-177, S-18C and S-197 to the existing Aerojet Canal, and an above ground infiltration basin to be constructed within the District owned Frog Pond lands. Marsh stage triggers in Taylor Slough, and elsewhere in the adjacent basin, will be used to manage pumping rates, and the distribution of water to offset the seepage affects of the lower C-111 Canal system. Creation of this hydrologic ridge will be accomplished by installation of additional intermediate water control structures on the lower C-111 Canal and operational changes at S-18C and S-197 structures to increase the effective water control elevation of the lower C-111 Canal. These intermediate structures and operational changes will facilitate reducing the seepage losses from Taylor Slough and increase the net water distributed west of the existing C-111 Canal system.

In addition to the features described above, Alternative 2DShort includes at least one new operable structure in the lower C-111 Canal just south of the existing S-18C structure (two operable structures were suggested in the Recommended Plan, but a design has not yet been chosen), a plug at S-20A, and operational changes at S-20 (both located on L-31E) (Figure 11).

Recommended Plan Elements

The C-111 SC Phase 1 Project Recommended Plan includes the following features:

- Frog Pond Infiltration Basin
- Aerojet Canal
- Intermediate Water Control Feature
- Incremental S-18C Changes
- L-31E Canal Plug and Operational Change at S-20A
- C-110 Canal Plugs

The Frog Pond Infiltration Basin and Aerojet Canal features are intended to work in unison to create an approximately 9-mile hydraulic ridge. The ridge will serve to block groundwater flows from moving into the C-111 Canal, therefore retaining water in Taylor Slough and improving the quantity, timing, and duration of flows into Florida Bay. The remaining features of the Recommended Plan will serve to provide a jumpstart to environmental restoration in the Southern Glades and Model Lands.

Frog Pond Infiltration Basin

As planned, a 225-cfs pump station, to be constructed downstream of S-176, will route excess water, which would otherwise be discharged down the lower C-111 Canal via S-177, to an approximately 530 acres (interior surface area) above ground infiltration area to be constructed within the southern portion of the District owned Frog Pond Lands.

The infiltration area will have an integral cascading header canal, which will stage up approximately 2.5 feet above existing ground level before “feeding” the three cells, which will make up the infiltration area. Weirs will be constructed between the header canal and receiving cell to ensure that the header stage rises sufficiently to maintain hydraulic head prior to discharging to the reservoir cells. A series of cascading weirs will be constructed within the header canal to ensure that potentiometric heads are maximized. The header cell will be fed by a lined conveyance channel (alternatively pipes) located along the northern limits of the reservoir. The 225-cfs pump station will consist of three 75-cfs pumps to allow stepped operations. In order to prevent overflowing, pumping will be discontinued if the elevation of the header canal exceeds 2.5 feet above the existing ground. Pumping will also cease if ponding within sparrow subpopulation C reaches a depth of 10 centimeters (during March 1 to July 15), as measured at a pre-determined representative trigger cell location at 4.8 feet elevation NGVD29.

Aeroject Canal

A second 225-cfs pump station, will be constructed immediately upstream of S-177, downstream of State Road 9336. This pump station will work in tandem with the Frog Pond Infiltration Basin, will mirror the Frog Pond Infiltration Basin pump's operations, and water that would otherwise be discharged via S-177 would be routed to the existing Aerojet Canal via a northerly extension of the canal, or via the existing L-31W Canal. Similar to the Frog Pond Infiltration Basin's header cell, potentiometric heads within the Aerojet Canal and their effect in surrounding marshlands will be investigated through the use of cascading weirs or containment of canal water through perimeter berming. Similar to the Frog Pond Infiltration Basin pump station, pumping will be discontinued if the elevation of the canal exceeds 2.5 feet above existing ground. Pumping will also cease if ponding within sparrow subpopulation D reaches a depth of 10 centimeters (during March 1 to July 15), as measured at a pre-determined representative trigger cell location at 2.1 feet elevation NGVD29. An appropriately sized pump station would be constructed, south of State Road 9336, just upstream of S-177 to maximize the hydraulic ridge between S-177 and S-18C, which is reportedly the leakiest section of the C-111 Canal system.

Once the Aerojet Canal has reached some equilibrium with marsh stage triggers in Taylor Slough and adjacent marsh areas, or as additional water becomes available upstream of S-177, excess water (which would have otherwise been discharged via S-177) would be routed to the proposed Frog Pond Infiltration Basin via an appropriately sized pump station constructed downstream of S-176. The combined effects of the Frog Pond Infiltration Basin and Aerojet Canal hydraulic ridge would extend the effective seepage control between S-176 and roughly S-18C.

Intermediate Water Control Features

The plan also includes an operable "S-197 like" structure within the lower C-111 Canal, located between S-18C and the theoretical confluence of the C-111 Canal with a theoretical extension of the C-110 Canal. The proposed structure, called S-198, is intended to reduce current levels of seepage from the lower C-111 Canal, while preserving existing levels of flood damage reduction. The S-198 structure is intended to increase water levels upstream of S-18C and raise water levels in the marsh between Taylor Slough and the C-111 Canal, and further reduce overall seepage losses towards the east. Although opportunities exist for optimizing their design and operations, for simplicity, this structure was modeled identical to S-197.

Incremental S-18C Changes

In order to maximize restoration opportunities, the recommended plan includes incremental increases in the current open and close triggers at structure S-18C. Open and close triggers will be increased in increments of no more than 0.1 feet per year, and the total change in either trigger shall not exceed 0.4 feet over the life of project operations. Stage override triggers (to be determined) will be established immediately downstream of S-177 and/or in the adjacent farm fields to establish a "backstop" at which S-18C triggers will return to their existing levels.

L-31E Canal Changes

The recommended plan includes construction of a permanent plug at S-20A and operational changes at S-20. The proposed plug near S-20A and proposed operational changes at S-20, specifically raising the open and close triggers 0.5 feet, are intended to more closely mimic pre-drainage hydroperiods within the Model Lands.

C-110 Canal Changes

Finally, the recommended plan includes construction of earthen plugs at key locations within the C-110 Canal in order to promote sheetflow within the Southern Glades. As currently envisioned, a minimum of nine plugs will be constructed at semi-regular intervals by using the original spoil material that was placed along the excavated canal banks. Excess spoil not utilized in construction of the plugs will be placed into the canal to further promote sheetflow and to lessen the effects of the remaining canal segments.

Due to the uncertainty of the impacts on the environment and regional flood control system associated with the first increment of restoration, implementation of the plan will itself be incremental and may include temporary construction features that will be adapted for further modification. Flexibility in the design and installation of water control features recommended in this plan will provide an opportunity to evaluate critical system responses such as flood control, water supply and ecological response.

C-111 Spreader Canal Design Test Project

The Design Test is a pilot project level investigation that will be tested to determine the constructability and operation of a small-scale spreader canal concept and provide learning opportunities for decision making related to the feasibility of larger scale spreader canal implementation during the C-111 SC Project Phase 2. Effects of the Design Test are considered in a separate consultation and are not included as part of this Biological Opinion. The proposed Design Test canal will begin where C-111E intersects 424th Street (Work Camp Road), and run approximately one mile east along 424th Street. This project will involve placing small temporary pumps at C-111E and 424th Street and constructing sections of both a conveyance canal and a spreader canal. To the extent practical, existing drainage features will be used with some improvements. Various pumping scenarios (including duration and ambient hydrological conditions) will be tested to determine their extent and effect on below and above ground water levels, acreage affected, infiltration rates, flow gradient direction, and water quality. The project duration is expected to be 2 to 3 years; 1 year of baseline monitoring plus 1 to 2 years of additional monitoring after the Design Test goes on-line. It is anticipated that this will be a temporary project, and will be dismantled if it cannot be incorporated into the full-scale C-111 SC Project at the completion of Design Test monitoring. The Service completed their section 7 consultation on this project on June 30, 2009.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project (Figure 12) includes the southeast and "panhandle" portions of ENP, the Southern Glades Wildlife Management Area and Model Lands (Figure 13), northeast Florida Bay, Barnes Sound, Card Sound, and associated adjoining estuarine zones, bays and sounds, agricultural and urban areas in and surrounding Homestead and Florida City, Florida, and all adjacent lands that may be affected by changes in hydrology caused by the proposed actions. This area includes those lands and waters supporting populations of threatened and endangered species, and their designated critical habitats, likely to be directly or indirectly affected by the proposed action.

STATUS OF THE SPECIES/CRITICAL HABITAT

Eastern Indigo Snake

Species/critical habitat description

The eastern indigo snake is the largest non-venomous snake in North America, obtaining lengths of up to 8.5 feet (2.6 meters) (Moler 1992). Its color is uniformly lustrous-black, dorsally and ventrally, except for a red or cream-colored suffusion of the chin, throat, and sometimes the cheeks. Its scales are large and smooth (the central 3 to 5 scale rows are lightly keeled in adult males) in 17 scale rows at mid-body. Its anal plate is undivided. In the Florida Keys, adult indigo snakes seem to have less red on their faces or throats compared to most mainland specimens (Lazell 1989). Several researchers have informally suggested that Lower Keys indigo snakes may differ from mainland snakes in ways other than color.

Critical habitat has not been designated for this species.

Life history

In south-central Florida, limited information on the reproductive cycle suggests that eastern indigo snake breeding extends from June to January, egg laying occurs from April to July, and hatching occurs from mid-summer to early fall (Layne and Steiner 1996). Young hatch approximately 3 months after egg-laying and there is no evidence of parental care. Eastern indigo snakes in captivity take 3 to 4 years to reach sexual maturity (Speake et al. 1987). Female eastern indigo snakes can store sperm and delay fertilization of eggs. There is a single record of a captive eastern indigo snake laying five eggs (at least one of which was fertile) after being isolated for more than 4 years (Carson 1945). However, there have been several recent reports of parthogenetic reproduction by virginal snakes. Hence, sperm storage may not have been involved in Carson's (1945) example (Moler 1998). There is no information on the eastern indigo snake lifespan in the wild, although one captive individual lived 25 years, 11 months (Shaw 1959).

Eastern indigo snakes are active and spend a great deal of time foraging and searching for mates. They are one of the few snake species that are active during the day and rest at night. The eastern indigo snake is a generalized predator and will eat any vertebrate small enough to be overpowered. They swallow their prey alive. Food items include fish, frogs, toads, snakes (venomous, as well as non-venomous), lizards, turtles, turtle eggs, small alligators, birds, and small mammals (Keegan 1944; Babis 1949; Kochman 1978; Steiner et al. 1983).

Population dynamics

Eastern indigo snakes need a mosaic of habitats to complete their annual life cycle. Over most of its range, the eastern indigo snake frequents several habitat types, including pine flatwoods, scrubby flatwoods, high pine, dry prairie, tropical hardwood hammocks, edges of freshwater marshes, agricultural fields, coastal dunes, and human-altered habitats. Eastern indigo snakes also use some agricultural lands (such as citrus) and various types of wetlands (Service 1999). A study in southern Georgia found that interspersion of tortoise-inhabited sandhills and wetlands improve habitat quality for the eastern indigo snake (Landers and Speake 1980; Service 2004a). Eastern indigo snakes shelter in gopher tortoise burrows, hollowed root channels, hollow logs, or the burrows of rodents, armadillos, or land crabs (Lawler 1977; Moler 1985a; Layne and Steiner 1996). Throughout peninsular Florida, this species may be found in all terrestrial habitats which have not experienced high density urban development. They are especially common in the hydric hammocks throughout this region (Service 1999). In central and coastal Florida, eastern indigo snakes are mainly found within many of the State's high, sandy ridges. In extreme south Florida (*i.e.*, the Everglades and Florida Keys), eastern indigo snakes are found in tropical hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats (Steiner et al. 1983; Service 1999). Underground refugia used by this species include natural ground holes; hollows at the base of trees or shrubs; ground litter; trash piles; and in the crevices of rock-lined ditch walls (Layne and Steiner 1996). It is thought that they prefer hammocks and pine forests since most observations occur there and use of these areas is disproportionate compared to the relatively small total area of these habitats (Steiner et al. 1983). Observations over the last 50 years made by maintenance workers in citrus groves in east-central Florida indicate that eastern indigo snakes are occasionally observed on the ground in the tree rows and more frequently near the canals, roads, and wet ditches (Zeigler 2006). In the sugar cane fields at the A-1 Reservoir Project site in the Everglades Agriculture Area, eastern indigo snakes have been observed (including one mortality) during earthmoving and other construction-related activities.

Eastern indigo snakes range over large areas and use various habitats throughout the year, with most activity occurring in the summer and fall (Smith 1987; Moler 1985a). Adult males have larger home ranges than adult females and juveniles; their ranges average 554 acres, decreasing to 390acres in the summer (Moler 1985b). In contrast, a gravid female may use from 3.5 to 106 acres (Smith 1987). In Florida, home ranges for females and males range from 5 to 371 acres and 4 to 805 acres, respectively (Smith 2003). At the Archbold Biological Station (ABS), average home range size for females was determined to be 47 acres and overlapping male home ranges to be 185 acres (Layne and Steiner 1996).

Status and distribution

The eastern indigo snake was listed as threatened on January 31, 1978 (43 FR 4028), due to population declines caused by habitat loss, over-collecting for the domestic and international pet trade, and mortality caused by rattlesnake collectors who gas gopher tortoise burrows to collect snakes. The indigo snake ranges from the southeastern United States to northern Argentina (Conant and Collins 1998). This species has eight recognized subspecies, two of which occur in the United States: the eastern indigo and the Texas indigo (*D. c. erebennus*). In the United States, the eastern indigo snake historically occurred throughout Florida and in the coastal plain of Georgia and has been recorded in Alabama and Mississippi (Diemer and Speake 1983; Moler 1985b). It may have occurred in southern South Carolina, but its occurrence there cannot be confirmed. Georgia and Florida currently support the remaining endemic populations of the eastern indigo snake (Lawler 1977). The eastern indigo snake occurs throughout most of Florida and is absent only from the Dry Tortugas and Marquesas Keys, and regions of north Florida where cold temperatures and deeper clay soils exist (Cox and Kautz 2000).

Effective law enforcement has reduced pressure on the species from the pet trade. However, because of its relatively large home range, the eastern indigo snake is vulnerable to habitat loss, degradation, and fragmentation (Lawler 1977; Moler 1985a). The primary threat to the eastern indigo snake is habitat loss due to development and fragmentation. In the interface areas between urban and native habitats, residential housing is also a threat because it increases the likelihood of snakes being killed by property owners and domestic pets. Extensive tracts of undeveloped land are important for maintaining eastern indigo snakes. In citrus groves, eastern indigo snake mortality occurs from vehicular traffic and management techniques such as pesticide usage, lawn mowers, and heavy equipment usage (Zeigler 2006). Within the 2000 to 2005 timeframe, since the spread of citrus canker, Zeigler (2006) reported seeing at least 12 dead eastern indigo snakes that were killed by heavy equipment operators in the act of clearing infected trees.

Tasks identified in the recovery plan for this species include; habitat management through controlled burning, testing experimental miniature radio transmitters for tracking juveniles, maintenance of a captive breeding colony at Auburn University, recapture of formerly released eastern indigo snakes to confirm survival in the wild, educational lectures and field trips, and efforts to obtain landowner cooperation in conservation efforts (Service 1999).

To protect and manage this species for recovery, Breininger et al. (2004) concluded that the greatest eastern indigo snake conservation benefit would be accrued by conserving snake populations in the largest upland systems that connect to other large reserves while keeping edge to area ratios low. Management of these lands should be directed towards maintaining and enhancing the diversity of plant and animal assemblages within these properties. Where these goals are achieved, eastern indigo snakes will directly benefit because of improved habitat conditions. Land managers should be encouraged to utilize fire as a tool to maintain biodiversity in fire-dependent ecosystems.

Analysis of the species/critical habitat likely to be affected

The eastern indigo snake may be present within and adjacent to the proposed project boundaries. Most of the potential C-111 SC study area can be considered eastern indigo snake habitat except for open water not associated with tree islands, levees, or banks and disturbed areas not associated with vegetative cover. Indigo snakes range over large areas and into various habitats throughout the year with most activity occurring in the summer and fall. The eastern indigo snake will use most of the habitat types available in its home range, but prefers open undeveloped areas. This species requires sheltered "retreats" from winter cold and desiccating conditions, such as gopher tortoise burrows. Eastern indigo snakes are known to use levees which impound water in south Florida. Because of its relatively large home range (185 acres for males and 47 acres for females), this snake is especially vulnerable to habitat loss, degradation, and fragmentation (Service 1999). Eastern indigo snakes are known to occur in the vicinity of the action area (Figure 8) and could be adversely affected by the proposed action. The Corps' commitment to implement the *Standard Protection Measures for the Eastern Indigo Snake* (Service 2004a) will provide some level of protection but not preclude the possibility that indigo snakes could occur in areas where they could accidentally be killed during construction activities. Therefore the Service does not concur with the Corps' determination of "may affect, not likely to adversely affect" for the eastern indigo snake for the construction and operation of the proposed C-111 SC Project, instead the Service has determined that the C-111 SC Project "may affect, and is likely to adversely affect" the eastern indigo snake.

No critical habitat has been designated for the eastern indigo snake; therefore, none will be affected.

Cape Sable Seaside Sparrow

Species/critical habitat description

The Cape Sable seaside sparrow is one of eight extant subspecies of seaside sparrow in North America. Its distribution is limited to the short-hydroperiod wetlands at the bottom of the greater Everglades system, on the southern tip of mainland Florida. This sparrow is a medium-sized bird, 5.1 to 5.5 inches (13 to 14 centimeters) in length. Unlike most other subspecies of seaside sparrow, which occupy primarily brackish tidal systems (Post and Greenlaw 1994), the sparrow currently occurs primarily in the short-hydroperiod wet prairies, also referred to as marl prairies. The sparrow is generally sedentary, secretive, and non-migratory, occupying the marl prairies of southern Florida year-round.

The Cape Sable seaside sparrow was first provided protection when it was listed on March 11, 1967, under the Endangered Species Preservation Act of 1967 (32 FR 4001).

Protection for the sparrow was continued under the Endangered Species Conservation Act of 1969 and the Act of 1973. The sparrow and all other species listed under the Endangered Species Conservation Act were the first species protected under the Act of 1973, as amended, and all of these species were given the 'endangered' designation.

Life history

Breeding and Nesting Behaviors

Cape Sable seaside sparrows are thought to be monogamous (Post and Greenlaw 1994), with a single female occurring within a male's breeding territory. However, recent information indicates that sparrows may be polygamous under some circumstances, such as within small populations, however it is unknown whether the birds are simultaneously or sequentially polygamous (Lockwood et al. 2006).

During the breeding season (March to August), male sparrows establish and defend territories that are variable in size, ranging from 0.7 to 16.8 acres (0.3 to 6.8 hectares) (Werner 1975), with reported average sizes ranging from 2.2 to 8.9 acres (0.9 to 3.6 hectares) within different sites and years (Werner and Woolfenden 1983; Pimm et al. 2002). Throughout the breeding season, the majority of a sparrow pair's activities occur within this territory, including breeding, feeding, and sheltering. Within an area of suitable habitat, territories do not appear to be tightly packed (Werner 1975), and there are gaps between defended boundaries of adjacent males. It is likely that sparrows venture into these 'unclaimed areas" during the breeding season.

Sparrows generally begin nesting in early March (Lockwood et al. 2001), but may begin territorial behavior, courtship, and nest-building in late February (Werner and Woolfenden 1983; Lockwood et al. 1997). This timing coincides with the dry season, and most areas within the marl prairies are either dry or only shallowly inundated at the beginning of the breeding season. During the dry portion of the breeding season (March to May), sparrows build nests above the ground, but relatively low in the vegetation (6.7 to 7.1 inches [17 to 18 centimeters]) (Werner 1975; Lockwood et al. 2001). Nests are woven into clumps of dense vegetation and are well-concealed (Werner 1975; Post and Greenlaw 1994). Nest cups are consistently concealed from above (Post and Greenlaw 1994), either through construction of a domed cover or through modifying vegetation in the vicinity (Werner 1975; Post and Greenlaw 1994). During the wet portion of the sparrow breeding season (June to August), sparrows build their nests higher in the vegetation than during dry periods, an average of 8.3 inches (21 centimeters) above the ground surface (Lockwood et al. 2001). Wet-season nests probably occur in taller vegetation than during the dry season because even at the nest height, there must be sufficient height and density of vegetation remaining above the nest to cover and conceal nests.

Pimm et al. (2002) suggest that nesting will not be initiated if water levels are at a depth greater than 4 inches (10 centimeters) during the breeding season. For many years, rising water levels resulting from the onset of summer rains were thought to end the breeding season (Werner 1975). While these statements are true, the sparrows may respond to changes in hydrologic conditions as long as water levels are not prohibitively high. Large rainfall events early in the wet season may cause some nest failure and sparrows generally cease breeding when water levels rise above the mean height of the nests from the ground (Lockwood et al. 1997; Basier et al. 2008; Cade and Dong 2008). However, if water levels subsequently drop, sparrows may again initiate breeding activity. The initiation of molt, which usually occurs in early September, is probably the best indicator of the true end of breeding season.

The sparrow nesting cycle, from nest construction to independence of young, lasts about 30 to 50 days (Werner 1975; Lockwood et al. 2001), and sparrows may renest following both successful and failed nesting attempts (Werner 1975; Post and Greenlaw 1994; Lockwood et al. 2001). Both parents rear and feed the young birds and may do so for an additional 10 to 20 days after the young fledge (Woolfenden 1956, 1968; Trost 1968). They are incapable of flight until they are about 17 days of age; when approached, flightless fledglings will freeze on a perch until the threat is less than a 3 feet (1 meter) away, and then run along the ground (Werner 1975; Lockwood et al. 1997).

Because of the long breeding season in southern Florida, sparrows regularly nest several times within a year, and may be capable of successfully fledging 2 to 4 clutches, though few sparrows probably reach this level of success (Lockwood et al. 2001). Second and third nesting attempts may occur during the early portion of the wet season, and nests later in the season usually occur over water.

Nest success rates vary among years, and range from 12 to 53 percent (Lockwood et al. 2001). Nest predation is the primary documented cause of nest failure (Pimm et al. 2002), accounting for more than 75 percent of all nest failures (Lockwood et al. 1997; Basier et al. 2008). As water levels begin to rise above ground surface with the onset of the summer rains in May to June, nest predation rates also rise. Nests that are active after June 1, when water levels are above ground, are more than twice as likely to fail as nests during drier periods (Lockwood et al. 2001; Basier et al. 2008; Cade and Dong 2008). This effect appears to be a result of both increased likelihood of nests being flooded and an increased likelihood of predation (Lockwood et al. 1997, 2001; Pimm et al. 2002).

Outside of the breeding season, sparrows generally remain sedentary in the general vicinity of their breeding territories, but expand the area that they use compared to the breeding season territory (Dean and Morrison 2001). Average non-breeding season home range size was about 42.1 acres (17.1 hectares) in size, and ranged from 14.1 to 137.1 acres (5.7 to 55.5 hectares) (Dean and Morrison 2001). Some individuals make exploratory movements away from the area of their territories, and may occasionally relocate their territories and home ranges before resuming a sedentary movement pattern (Dean and Morrison 2001).

Sparrow subpopulations require large patches of contiguous open habitat (about 4,000 acres or larger). The minimum area required to support a population has not been specifically determined, but the smallest area that has remained occupied by sparrows for an extended period about 4,000 acres. Individuals are area-sensitive, and generally avoid the edges where other habitat types meet the marl prairies. They will only occupy small patches (less than 100 acres) of marl prairie vegetation when they occur within large, expansive areas and are not close to forested boundaries (Dean and Morrison 2001). Once sparrows establish a breeding territory, they exhibit high site fidelity, and each individual sparrow may only occupy a small area for the majority of their lives. Because sparrows are generally sedentary and avoid forested areas, they are not likely to travel great distances to find mates or to find outlying patches of suitable habitat.

The occurrence of sparrows over time within each of the subpopulations shows a centrality, in which sparrows most consistently occur and are most abundant near the center of the patch of habitat in which they occur.

Within a patch of occupied suitable habitat, sparrow breeding territories do not generally saturate the entire area. Even when sparrows occur at high densities, small areas usually remain between adjacent territories, though some territories also appear to overlap. In addition, some gaps that appear to be suitable habitat may remain unclaimed by territorial birds (Werner 1975). In many cases, areas that appear to be suitable for sparrow occupancy may not be suitable during certain environmental conditions and this may cause sparrow territories to appear to be widely separated from neighboring territories.

Cape Sable seaside sparrows are generally short-lived, with an average individual annual survival rate of 66 percent (Lockwood et al. 2001). The average lifespan is probably 2 to 3 years. Consequently, a sparrow population requires favorable breeding conditions in most years to be self-sustaining, and cannot persist under poor conditions for extended periods (Lockwood et al. 1997; Lockwood et al. 2001; Pimm et al. 2002).

Feeding Behavior

While detailed information about the diet of Cape Sable seaside sparrows is not known, invertebrates comprise the majority of their diet, though sparrows may also consume seeds when they are available (Werner 1975; Post and Greenlaw 1994). Howell (1932) identified the contents of 15 sparrow stomachs and primarily found remains of insects and spiders, as well as amphipods, mollusks, and plant matter. Primary prey items that are fed to nestlings during the breeding season include grasshoppers (Orthoptera), moths and butterflies (Lepidoptera), dragonflies (Odonata), and other common large insects (Post and Greenlaw 1994; Lockwood et al. 1997). Adult sparrows probably consume mainly the same species during the nesting season. Sparrows may consume different proportions of different species over time and among sites, suggesting that they are dietary generalists (Pimm et al. 2002). During the non-breeding season, preliminary information from evaluation of fecal collections suggests that a variety of small invertebrates, including weevils and small mollusks are regularly consumed (Dean and Morrison 2001). Evidence of seed consumption was only present in four percent of samples (Dean and Morrison 2001). These non-breeding season samples may not be representative of the foods most frequently consumed during that season and may only represent a portion of the items ingested.

While the sparrow appears to be a dietary generalist, an important characteristic of sparrow habitat is its ability to support a diverse array of insect fauna. In addition, these food items must be available to sparrows both during periods when there is dry ground and during extended periods of inundation. The specific foraging substrates used are unknown, but they probably vary throughout the year in response to hydrologic conditions.

Habitat and Hydrologic Requirements

Sparrows inhabiting the C-111 SC Project study area occur mostly within the short-hydroperiod freshwater marl prairies of the southern Everglades that flank the deeper sloughs. The most commonly associated vegetation species in occupied freshwater habitats is muhly grass (*Muhlenbergia filipes*) (Werner 1975; Kushlan and Bass 1983; Werner and Woolfenden 1983; Post and Greenlaw 1994). However, a variety of vegetation species occurs within the freshwater marl prairies occupied by sparrows, including habitat from which *Muhlenbergia* is absent (Ross et al. 2006). Other dominant species that occur in these prairies include sawgrass, south Florida bluestem (*Schizachyrium rhizomatum*), black-topped sedge (*Schoenus nigricans*), and beak rushes (*Rhynchospora* spp.), (Werner and Woolfenden 1983; Ross et al. 2006).

Sparrows occupy these marl prairie communities year-round, and the vegetation must support all sparrow life stages. During periods when the communities are dry, usually coinciding with the late winter and early spring (December to May), sparrows traverse the ground surface beneath the grasses, and only occasionally perch within the vegetation. During the wet season (June to November), the ground surface is inundated, with peak water depths occasionally exceeding 2 feet (0.6 meter) (Nott et al. 1998). During these periods, sparrows travel within the grasses, perching low in the clumps, hopping among the bases of dense grass clumps, and walking over matted grass litter. During the wet season sparrows fly more frequently, and regularly perch low in the vegetation, but generally remain inconspicuous (Dean and Morrison 2001).

Small tree islands and individual trees and shrubs occur throughout the areas occupied by the sparrows, but at a very low density. Sparrows do not appear to require woody vegetation during any aspect of their normal behavior, and generally avoid areas where shrubs and trees are either dense or evenly distributed. However, the small tree islands and scattered shrubs and trees may serve as refugia during extreme environmental conditions, and may be used as escape cover when fleeing from potential predators (Dean and Morrison 2001). Because of their general aversion to dense trees and woody vegetation, encroachment of trees and shrubs quickly degrades potential habitat.

Hydrologic conditions have significant direct and indirect effects on sparrows. First, depth of inundation within sparrow habitat is directly related to the sparrow's ability to move, forage, nest, find shelter, and avoid predators and harsh environmental conditions. Average annual rainfall in the Everglades is about 56 inches (142 centimeters) per year (ENP 2005), with the majority of this falling within the summer months, which coincides with the latter half of the sparrow nesting season. This rainfall has a strong influence on the hydrologic characteristics of the marl prairies. However, throughout southern Florida, including sparrow habitat, hydrologic conditions are also influenced by water management actions. The operation of a system of canals, levees, pumps, and other water management structures, can have wide-ranging impacts on the hydrologic conditions throughout much of the remaining marl prairies (Johnson et al. 1988; Van Lent and Johnson 1993; Pimm et al. 2002).

At water levels over 2 feet (0.6 meter) above ground surface, the majority of the vegetation in sparrow habitat is completely inundated, leaving sparrows with limited refugia. Conditions such as these may result in significant impacts to sparrow survival, and if they occur during the breeding season, these water levels will cause flooding and loss of sparrow nests (Nott et al. 1998; Pimm and Bass 2002). Even more moderate water levels, in the range of 6 inches (15 centimeters) above ground surface, may inundate enough habitat that sparrows cannot find shelter and are restricted in their movements. These water levels, when they occur during the nesting season, result in increased rates of nest failure due to predation (Lockwood et al. 1997; Basier et al. 2008). While elevational variation within the Everglades is small, differences in elevation as small as 1 foot (30 centimeters) can result in different habitat characteristics.

The vegetation species composition and density in the Everglades are largely influenced by hydroperiods. Hydroperiods that range from 60 to 270 days support the full variety of vegetation conditions that are generally suitable for sparrows (Ross et al. 2006), though the vegetation composition and structure may vary significantly. Persistent increases in hydroperiod may result in changes in vegetation communities from marl prairies or mixed prairies to sawgrass-dominated communities resembling sawgrass marshes (Nott et al. 1998). Detailed studies relating hydroperiod characteristics to sparrow habitat have concluded that an average annual discontinuous hydroperiod range (average number of days in a year that water stage is above ground level) of 60 to 180 days is optimal for the plant species important for sparrow nesting and for maintenance of sparrow habitat (Olmsted 1980; Kushlan et al. 1982; Kushlan 1990; Wetzel 2001; Ross et al. 2006).

Conversely, areas that are subjected to short hydroperiods generally have higher fire frequency than longer-hydroperiod areas (Lockwood et al. 2003; Ross et al. 2006), and are readily invaded by woody shrubs and trees (Werner 1975; Davis et al. 2005). Both an increased incidence of fire and an increased density and occurrence of shrubs detract from the suitability of an area as sparrow habitat.

The local variability across the landscape within areas where sparrows occur produces a heterogeneous arrangement of different vegetation conditions that all provide habitat for sparrows during some environmental conditions. A complex relationship between hydrologic conditions, fire history, and soil depth determine the specific vegetation conditions at a site, and variation in these characteristics may result in a complex mosaic of vegetation (Taylor 1983; Ross et al. 2006). This variability is characteristic of the habitats that support sparrows.

Population dynamics

Population Size and Variability

The use of helicopters to facilitate larger scale surveys for the sparrow was first accomplished in 1974 (Werner 1975). The first comprehensive, range-wide sparrow survey was conducted in 1981 and was not repeated until 1992. Since this time, surveys have been conducted annually including twice in 2000 (Pimm et al. 2002). Over this time period, there have been substantial changes in most of the six subpopulations (Table 3). The 1981 sparrow survey provided a good baseline on the distribution and abundance of sparrows at that time, and the 1992 survey results were remarkably similar, though there is no information available about how the population may have changed during the intervening 12 years. In 1981, there were an estimated 6,656 sparrows distributed across the six subpopulations, with most of the sparrows occurring within three large subpopulations (A, B, and E), and three smaller subpopulations (C, D, and F) (Table 3). Overall, there have been many large population declines recorded among all of the subpopulations, and relatively few population increases. These population changes suggest that while declines can occur rapidly, it may take many years of favorable conditions to return to a stable population.

Subpopulations B, C, and D occur within the C-111 SC Project study area. When first surveyed, subpopulation B contained an estimated 2,352 sparrows inhabiting the marl prairies southeast of Shark River Slough near the center of ENP. Subpopulation B remains one of the most abundant subpopulations, with the estimated size remaining relatively stable around 2,000 birds (Table 3). From 1981 to 2008, estimated population sizes have ranged from 1,888 to 3,184 birds. Subpopulation C, located in the vicinity of Taylor Slough and along the eastern boundary of ENP, and subpopulation D, just to the southeast of subpopulation C, each supported an estimated 400 sparrows when first surveyed in 1981. By the 1992 survey, subpopulation C had declined to about 11 percent of its 1981 estimated size (Table 3). After at least 2 years with no sparrows, 48 sparrows were thought to reside in this area in 1996 and 1997, and 80 sparrows were estimated in 1998. Despite irregular seasonal inundation and frequent fires, this subpopulation has shown recent signs of recovery (Cassey et al. 2007). Recent estimates of birds in subpopulation C have been relatively stable, and may suggest a slight increase. Subpopulation D declined to about 24 percent of its 1981 estimated size (Table 3). Although no sparrows were found in 1995, the population was estimated at 80 sparrows in 1996 and 176 sparrows in 1999. High water levels since 2000 likely led to the decrease since 1999 (Slater et al. 2009) with 32 sparrows estimated in 2001. No sparrows were identified within subpopulation D from 2002 through 2004, but they were detected in 2005. The continual decline since its 1981 estimate of 400 sparrows has possibly left this subpopulation functionally extirpated with few sparrows detected during the 2006 to 2007 range-wide surveys (Lockwood et al. 2008) Subsequent surveys, including preliminary results through 2009, have documented sporadic sparrow use. Preliminary results for 2009 reveal breeding and nesting activity in several areas within subpopulation D.

Population Stability

Recent information indicates that sparrow subpopulations C and D may support fewer sparrows than previously estimated, and the demographics of these subpopulations may differ from the larger subpopulations (Lockwood et al. 2006). Because sparrows typically experience low nest survival, low juvenile survival, and have a relatively short life span, we cannot expect sparrow recovery to be rapid (Lockwood et al. 2001). The demographic attributes of sparrows preclude them from rapid recovery particularly when consistently faced with poor conditions (*i.e.*, high water levels and frequent fires) (Lockwood et al. 2008). This information affects assessment of the likelihood of the persistence of these subpopulations and the overall probability of persistence for the species. With smaller population sizes in these subpopulations than previously assessed, the relative significance of subpopulations B and E with respect to maintaining a viable overall sparrow population is increased. Similarly, evaluations of the potential contributions of the small subpopulations to maintaining the overall sparrow population and buffering it from potential catastrophic events such as widespread fire are reduced. Pimm et al. (2002) and Walters et al. (2000) suggested that three breeding subpopulations are necessary to the long-term survival of the Cape Sable seaside sparrow. However, Slater et al. (2009) emphasize the need to recover all subpopulations, noting that with 90 to 97 percent of sparrows concentrated within two subpopulations (B and E), the species' vulnerability to stochastic events is particularly acute. Slater et al. (2008) observed that even though the overall sparrow population has remained stable since the massive decline it experienced in the 1990s, the population has shown minimal signs of recovery and little of the habitat restoration deemed necessary for their recovery.

Status and distribution

Reasons for Listing

From its initial discovery in the cordgrass (*Spartina* sp.) marshes on Cape Sable in 1918 (Howell 1919), followed by reports in what is now Everglades City (Nicholson 1928) as well as Ochopee (Anderson 1942), the Cape Sable seaside sparrow weathered hurricanes, fires, and habitat transitions. Subsequent population declines led to the sparrow's listing under the Endangered Species Conservation Act of 1969 and later by the Act of 1973. These historic populations have since been extirpated, but in 1972, sparrows were discovered near Taylor Slough, east of the "true" Everglades (Ogden 1972). Subsequent investigation revealed that a sparrow had been reported in this area in 1958, but the observation was never verified (Werner 1975; Pimm et al. 2002). Werner conducted helicopter surveys in 1974 and 1975 to characterize the distribution and abundance of sparrows in this region. These initial surveys revealed that sparrows were widely distributed and abundant (Werner 1975) and a subsequent 1981 survey (Kushlan and Bass 1983) delineated the six subpopulations that we currently monitor.

Rangewide Trend

Since 1992, the overall sparrow population has declined, and there has been no evidence of significant improvements. Subpopulations B and E have remained relatively stable, although notable annual variances have been observed. Subpopulation A numbers continue to exist at a very low level (Table 3). In addition to the decline in overall numbers, the distribution has declined. The sparrow subpopulations that have declined have mostly contracted toward the center of the remaining habitat patches.

New Threats

Small populations are particularly at risk from a catastrophic event or series of events, such as fire or major rainfall during the breeding season. About two thirds of the remaining Cape Sable seaside sparrows currently occur within Subpopulation B, which has remained relatively stable. However, if a large fire were to occur, there is a possibility the entire remaining Cape Sable seaside sparrow population may be reduced by 60 percent or more; the area has not burned in over a decade.

Climate Change

According to the Intergovernmental Panel on Climate Change (IPCC) Report (IPCC 2007), warming of the earth's climate is "unequivocal," as is now evident from observations of increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising sea level. The IPCC Report (2007) describes changes in natural ecosystems with potential wide-spread effects on many organisms, including marine mammals and migratory birds. The potential for rapid climate change poses a significant challenge for fish and wildlife conservation. Species' abundance and distribution are dynamic, relative to a variety of factors, including climate. As climate changes, the abundance and distribution of fish and wildlife will also change. Highly specialized or endemic species are likely to be most susceptible to the stresses of a changing climate. Based on these findings and other similar studies, the Department of the Interior requires agencies under its direction to consider potential climate change effects as part of their long-range planning activities (Service 2008a).

Climate change at the global level drives changes in weather at the regional level, although weather is also strongly affected by season and by local effects (*e.g.*, elevation, topography, latitude, proximity to the ocean). Temperatures are predicted to rise from 2°C to 5°C for North America by the end of this century (IPCC 2007). Other processes to be affected by this projected warming include rainfall (amount, seasonal timing, and distribution), storms (frequency and intensity), and sea level rise. However, the exact magnitude, direction, and distribution of these changes at the regional level are not well understood or easy to predict. Seasonal change and local geography make prediction of the effects of climate change at any location variable. Current predictive models offer a wide range of predicted changes.

The 2007 IPCC report found a 90 percent probability of 7 to 23 inches of sea level rise by 2100. Wanless et al. (1994) found that, over the past 2,500 years, south Florida has experienced an average rate of sea level rise of about 1.5 inches per century. Wanless (2008) also observed that south Florida has experienced about a 9-inch rise in sea level since 1932. This is about 8 times the average rate over the past 2,500 years. Much of this accelerated rise is the result of warming and expansion of water in the western North Atlantic Ocean.

Prior to the 2007 IPCC Report, Titus and Narayanan (1995) modeled the probability of sea level rise based on global warming. They estimated that the increase in global temperatures could likely raise sea level 6 inches by 2050 and 13 inches by 2100. While these estimates are lower than the estimates described in the IPCC Report (2007), Titus and Narayanan's (1995) modeling efforts developed probability-based projections that can be added to local tide-gauge trends to estimate future sea level at specific locations.

It should be noted that Titus and Narayanan's (1995) worst-case scenario was premised on a 1 percent chance that global warming would raise sea level that high. However, most climate change researchers agree with the findings in the IPCC Report (2007) which estimates a

90 percent probability of 7 to 23 inches of sea level rise by 2100. Scientific evidence that has emerged since the publication of the IPCC Report (2007) indicates an increase in the speed and scale of the changes affecting the global climate. Important aspects of climate change seem to have been underestimated and the resulting impacts are being felt sooner. For example, early signs of change suggest that the less than 1°C of global warming the world has experienced to date may have already triggered the first tipping point of the Earth's climate system – the disappearance of summer Arctic sea ice. This process could open the gates to rapid and abrupt climate change, rather than the gradual changes that have been currently forecasted.

Climatic changes in south Florida could amplify current land management challenges involving habitat fragmentation, urbanization, invasive species, disease, parasites, and water management (Pearlstine 2008). Global warming will be a particular challenge for endangered, threatened, and other "at risk" species. It is difficult to estimate, with any degree of precision, which species will be affected by climate change or exactly how they will be affected. The Service will use Strategic Habitat Conservation Planning, an adaptive science-driven process that begins with explicit trust resource population objectives, as the framework for adjusting our management strategies in response to climate change (Service 2006b).

Potential Non-native Invasive Species Impacts

The Burmese python (*Python molurus bivittatus)*, native to South Asia, is now breeding and expanding its range in the greater Everglades ecosystem increasing concerns among land managers about the potential impacts of this invasive snake. More than 935 of the south Asian snakes have been removed from ENP since 2000. Their population numbers are now estimated to be in the thousands in ENP potentially impacting a wide variety of listed and native species. A growing wild population of pythons has the potential to create a major ecological problem in ENP and threaten successful restoration of the greater Everglades (National Research Council 2005).

Pythons' rapid and widespread invasion is facilitated by aspects of their natural history such as diverse habitat use, broad dietary preferences, long lifespan (15 to 25 years), high reproductive output, and ability to move long distances. Burmese pythons are generalist predators that consume a wide variety of mammal and bird species, as well as other reptiles, amphibians, and fish (Snow et al. 2007). Like other constrictors, the Burmese python seizes prey with its teeth and then wraps its body around the animal and kills it by constriction. Pythons in Florida have consumed prey as large as white-tailed deer (*Odocoileus virginianus*) and adult American alligators (Snow et al. 2007). As Burmese pythons expand their range in South Florida, it becomes increasingly important to learn what they are eating in order to assess their impact on native fauna and to predict what species are at risk. Fourteen species of mammals, five species of birds, and one species of reptile have been found in the stomachs of pythons collected and examined in Florida (Snow et al. 2007). Although Cape Sable seaside sparrows have not been documented to have been predated upon by pythons, other bird species have been found in the digestive tracts of Burmese pythons, including pied-billed grebe (*Podilymbus podiceps*), limpkin (*Aramus guarauna*), white ibis (*Eudocimus albus*), American coot (*Fulica american*), house wren (*Troglodytes aedon),* Domestic goose (*Anser* sp*.)*, and a juvenile wood stork. There is documented overlap of Cape Sable seaside sparrow subpopulations and python occupied areas in ENP. The relative risk of python predation on sparrows is unknown at this time.

Critical habitat

Critical habitat for the Cape Sable seaside sparrow was initially designated on August 11, 1977 (42 FR 42840). The critical habitat designation was revised November 6, 2007 (50 FR 62736) and included the following primary constituent elements, the physical and biological features that are essential for conservation of the species:

1. Calcitic marl soils characteristic of the short-hydroperiod freshwater marl prairies of the southern Everglades. These soils support the unique vegetation community and probably many of the food items upon which sparrows depend. They also result from specific hydrologic conditions that are characteristic of the marl prairies. These soils are an integral component of sparrow habitat.

2. Herbaceous vegetation that includes greater than 15 percent combined cover of live and standing dead vegetation of one or more of the following species (when measured across an area of greater than 100 feet^2 (9.3 m^2): Muhly grass, Florida little bluestem , black-topped sedge, and cordgrass. These plant species are largely characteristic of areas where sparrows occur. They act as cover and substrate for foraging, nesting, and normal behavior for sparrows during a variety of environmental conditions. Many other herbaceous plant species and low-growing forbs also occur within sparrow habitat (Ross et al. 2006), and some of these may have important roles in the life history of the sparrow. However, the species identified in the PCE consistently occur in areas occupied by sparrows (Sah et al. 2007).

3. Contiguous open habitat. Sparrow subpopulations require large, expansive, contiguous habitat patches with few or sparse woody shrubs or trees. This PCE provides the space for population and individual growth, and also provides the open, contiguous habitat that sparrows prefer.

4. Hydrologic regime such that the water depth, as measured from the water surface down to the soil surface, does not exceed 7.9 inches (20 centimeters) for more than 30 days during the period from March 15 to June 30 at a frequency of more than 2 out of every 10 years.

Currently, critical habitat includes areas of land, water, and airspace in the Taylor Slough vicinity of Collier, Miami-Dade, and Monroe Counties. Much of this area is within the boundaries of ENP. The designated area encompasses about 84,865 acres (79,828 hectares), and includes portions of subpopulations B through F (Figure 14). Approximately 58,000 acres of Cape Sable seaside sparrow critical habitat in subpopulations B, C, and D are located within the C-111 SC Project study area.

ENVIRONMENTAL BASELINE

Eastern Indigo Snake

Status of the species within the action area

The size of the action area (project study area), represents a small portion of the combined acreage of all habitats usable by indigo snakes in south Florida. The C-111 SC construction footprint consists of several components, including the Frog Pond Infiltration Area, and levees and canal banks associated with C-111, C-111E, C-110, L-31E and Aerojet Canals within this action area (Figure 11). Although we have little information on the distribution and abundance of eastern indigo snakes within the action area, they have been documented using habitats similar to those impacted by the proposed action. No systematic surveys were conducted for the proposed action; however, at least seven indigo snakes have been sighted within the project area since 1951 (Figure 8) (Florida Natural Areas Inventory 2008). While no eastern indigo snakes have been sighted within the proposed construction footprint, the species could occur there. Eastern indigo snakes are present in similar habitats within the action area.

Factors affecting the species environment within the action area

The historic natural habitat of the C-111 SC Project study area was comprised of a mosaic of habitat types that included the upland areas favored by indigo snakes such as pine rocklands, tropical hardwood hammock, and the Atlantic Coastal Ridge that transitioned in lower areas to ridge and slough, sawgrass, marl prairie, and other graminoid wetlands interspersed with tree islands and finally mangroves in coastal areas (Service 1999).

Settlers to Miami-Dade County began modifying the natural hydrologic regime in the early 1920s to make the area more suitable for agriculture and urban development. The combined efforts of the State and Federal governments and private interests resulted in the construction of a network of water control structures, canals, and levees with the goal to eliminate flooding that frequently occurred in most of the area. Associated with this larger network, an expansive infrastructure of roads, berms, culverts, ditches, rock pits, building pads, etc. has further contributed to modification of the natural habitat. By 1967, an expansive engineering system known as the Central and Southern Florida (C&SF) Project had mostly taken control of the entire hydrologic system of Miami-Dade County.

Much of the project study area has been impacted by modifications to natural habitat, and by dredging, filling, farming, burning, introduction of exotic species, recreational activities, and urbanization. As the human population of south Florida continues to grow, the high ground of the Atlantic Coastal Ridge is becoming increasingly scarce as suburbia continues to move out into indigo snake habitats at the edge of or within remaining wetlands and into valuable farmland. Displaced farmers seeking new land have been forced to move further into the wetland areas.

The C-111 SC Project action area includes a variety of habitat types, both aquatic and terrestrial still used by eastern indigo snakes. Native habitat for fish and wildlife comprises only part of the project study area due to drainage, water management activities, urbanization, rock mining, and exotic plant infestations. Although degraded wetlands, agricultural fields and pastures, levees, canals, rock quarry lakes, and exotic vegetation have replaced wetland habitat in the remainder of the study area, they do provide some eastern indigo snake habitat.

It is not easy to estimate the density of eastern indigo snakes at the project site due to a general lack of data for the action area. Therefore, we used the data from other studies of eastern indigo snakes in Florida to estimate eastern indigo snake density on the project site. There is uncertainty around these estimates because they were not based on similar types of habitat but the study sites were located on similar latitudes in Florida. Regardless, we believe that the comparisons are valid and represent a conservative approach.

A 26-year study conducted by Layne and Steiner (1996) at ABS estimated a population density of 2.6 indigo snakes (1.9 males, 0.7 female) per 100 hectares (247 acres). Because this estimate was based on all indigo snakes in the area over the study period but not all were present at the same time, they also estimated a more conservative density based on 5 snakes (3 males and 2 females) that simultaneously occupied 314 hectares. Using this calculation, density was determined to be 1.6 indigo snakes per 100 hectares (0.96 male to 0.64 female). ABS contains high quality native snake habitat (*i.e.*, the study area was comprised of 60 percent xeric pine and oak uplands, and 40 percent pine flatwoods, bayheads, swale, and seasonal ponds). Eastern indigo snakes have been observed at ABS in all natural and man-altered habitats with no obvious habitat preferences (Layne and Steiner 1996). Layne and Steiner (1996) estimated eastern indigo snake densities and territory sizes for both genders of eastern indigo snakes. The average territory size for a male eastern indigo snake was approximately 185 acres.

The C-111 SC Project site likely contains or intersects some eastern indigo snake home ranges. Although the site is not sugar cane, the site does not contain optimal habitat for the eastern indigo snake and therefore compares more closely to the estimates for suboptimal habitat types. Therefore, we are using Layne and Steiner's (1996) estimates of densities to yield three territories within the construction footprint. Assuming that the eastern indigo snakes present at the C-111 SC Project site are present in a 1:1 sex ratio, the three territories would equate to six eastern indigo snakes.

There may be additional uncertainty regarding the sex ratio reported by Layne and Steiner (1996) at ABS. From a sample of 181 adult and juvenile eastern indigo snakes, Layne and Steiner (1996) found that 58 percent of the individuals were males and 42 percent were females. The juvenile eastern indigo snakes (< 800 millimeters; n = 36) were present at a 1:1 sex ratio, therefore, it was the larger snakes that skewed the sex ratio towards males. This led Layne and Steiner (1996) to postulate that the estimated adult sex ratio may be artificially skewed because males have larger home ranges and move more than females in winter. Therefore, male snakes may have a higher probability of being captured or killed by vehicular traffic (and thus added to their sample). It may be that an adult sex ratio of 1:1 is more appropriate for eastern indigo snakes. This ratio is more typical of colubrid snakes according to Parker and Plummer (2001).

A 1:1 sex ratio was also reported by Moulis (1976) for 11 captive hatchling indigo snakes. We have adopted a 1:1 sex ratio for this Biological Opinion.

We do not expect the fallow row crop fields and levee areas to solely comprise eastern indigo snake territories due to lack of cover; however, there are adequate resources along the drainage canal banks and fence lines to support eastern indigo snakes and their prey. Knowing that the males are territorial, we do not expect that existing territories would overlap to a large degree, however, female territories could overlap male territories.

Climate change will affect eastern indigo snake habitat through sea level rise although this is not anticipated to occur within the action area. More likely, altered weather patterns could affect water levels in wetlands and canals and, as a result, decrease prey densities. For example, more intense precipitation events could cause flooding or scouring. Increased periods of drought could reduce wetland prey habitat or refugia. It is also possible that an increase in the intensity or frequency of tropical storms may affect eastern indigo snakes by flood-related drowning (or effects related to moving out of flooded areas), loss of sheltering habitat, or direct impact with debris. These factors are difficult to quantify as the data for climate change impacts are not readily available for this area of Florida.

Cape Sable Seaside Sparrow

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation and the impact of State or private actions, which occur simultaneously with the consultation in progress.

The project study area includes the southeast and "panhandle" portions of ENP, the Southern Glades Wildlife Management and Model Lands Areas (Figure 13), northeast Florida Bay, Barnes Sound, Card Sound, and associated adjoining estuarine zones, bays, and sounds, agricultural and urban areas in and surrounding Homestead and Florida City, Florida, and all adjacent lands that may be affected by changes in hydrology caused by the proposed actions. Historically, the project study area consisted of a natural Everglade's type landscape including sloughs, tree islands, long-hydroperiod marshes, shorter-hydroperiod marl prairie, sawgrass marshes, and coastal mangrove fringe. Some of this land has been converted to urban development, active agriculture composed of fruit tree groves, row and field crops, and plant nurseries, and abandoned former agricultural areas that have been recolonized by a variety of native and invasive plant species.

Water management and flood control is achieved in south Florida through a variety of canals, levees, pumping stations, and control structures that have been constructed as part of the C&SF Project and ENP, South Dade Conveyance System (SDCS) including the Water Conservation Areas (WCAs) and southern Florida. The WCAs provide a detention reservoir for excess water from the Everglades Agricultural Area and parts of the east coast region, and for flood discharge from Lake Okeechobee to the sea. The WCAs provide levees to: prevent Everglades floodwaters from inundating the east coast urban areas; provide a water supply for the east coast areas and ENP; improve water supply for east coast communities by recharging underground freshwater reservoirs; reduce seepage; protect against salt-water intrusion in coastal well-fields; and provide habitat for fish and wildlife in the Everglades. The regulation schedules contain instructions and guidance on how project spillways are to be operated to maintain water levels in the WCAs. The regulation schedules essentially represent the seasonal and monthly limits of storage. The schedules vary from high stages in the late fall and winter to low stages at the beginning of the wet season. These regulation schedules must take into account various, and often conflicting, purposes. The East Coast Canals are flood control and outlet works that extend from St. Lucie County southward through Martin, Palm Beach, and Broward Counties to Miami-Dade County. The East Coast Canal watersheds encompass the primary canals and water control structures located along the lower east coast of Florida and their hydrologic basins. The main design functions of the canals and structures in the East Coast Canal area are to: protect the adjacent coastal areas against flooding; store water in conservation areas west of the levees; control water elevations in adjacent areas; prevent salt-water intrusion and over drainage; provide freshwater to Biscayne Bay and provide for water conservation and public consumption. There are 40 independently operated canals, 1 levee, and 50 operating structures, consisting of 35 spillways, 14 culverts, and 1 pump station. The flood control system works to prevent major flood damage. However, due to urbanization, the existing surface water management system now has to handle greater peak flows than in the past. The ENP-SDCS provides a way to deliver water to areas of south Miami-Dade County. This canal system was overlain on top of the existing flood control system. Many of these canals are used to remove water from interior areas to tidewater in times of excess water.

The ENP-SDCS was authorized for the purpose of improving the supply and distribution of water supplies to ENP and for expanding agricultural and urban needs. Before supplemental water is introduced into the system, canal stages are permitted to recede approximately 1.5 feet below the design optimums. Optimum and design water levels in the project canals are established on the basis of desirable water control conditions in each area, i.e., optimum groundwater levels, intake and/or discharge structure elevations and removal rates for flood control. Along the east coast salinity control is included as a requirement of canal-level design criteria. The purpose of S-18C is to maintain desirable water levels in the upstream reach of C-111 Canal, pass flood flows up to 40 percent standard project flood without exceeding design stages upstream, and act as a control point for water deliveries to the Eastern Panhandle of the ENP.

The purpose of S-197 is to maintain sufficient water control stages in the upstream section of C-111 Canal to prevent saltwater intrusion. Originally constructed as an earthen plug which would be excavated before or after major storm events, three gated culverts were subsequently added in order to avoid the over drainage, and damaging freshwater releases, associated with excavating the canal plug. Following a particularly damaging discharge in 1988, the District installed 10 additional culverts at S-197 adjacent to the three original culverts. The added operational flexibility provided by the 13 gated culverts has significantly lowered the volume of unnecessary discharges before, during, and after major storm events. Additional reductions in the frequency, degree, and duration of S-197 openings have also been realized by removal of the spoil mounds adjacent to the lower C-111 Canal. Currently, water which discharges from

S-18C, is allowed to flow over the scraped down canal banks into ENP's panhandle, and towards Florida Bay.

Even further reductions in the frequency, degree, and duration of S-197 openings have been realized as a result of Districts's construction of a new gated culvert structure, G-211, in the L-31N Borrow Canal immediately south of its intersection with C-1. As a result, during the experimental program, there has been a reduction in the need for S-331 discharges. With G-211 in place, S-331 has been used to pump water levels in the canal immediately adjacent to the 8.5 Square Mile Area in order to drain groundwater from the area. Previously, S-331 had to pump water levels in the L-31N Canal all the way upstream to U.S. Highway 41. However, the existing operations allow for regulatory releases to be passed into ENP-SDCS via S-333, S-334, G-211, and S-331, which typically increase pumping at S-331.

The purposes of the canal system in South Dade County are: to remove 40-percent standard project flood runoff from the effective drainage area; to reduce depth and duration of larger floods; provide water control to prevent over drainage in the area; prevent saltwater intrusion; and provide facilities to convey water to ENP when runoff is available. The ENP-SDCS modified the existing project works in south Miami-Dade County. The current operation of the SDCS, is detailed in the May 2002 Interim Operational Plan (IOP) Final EIS. The current operating plan has allowed some improvement in the eastern subpopulations that prior to IOP were too dry and therefore susceptible to wildfire. In the project study area this has been the case in sparrow subpopulation C. The intent of the proposed action is to create a hydrologic buffer between ENP and the C-111 Canal such that water levels in the adjacent marshes can be maintained, while abnormally long and severe dry periods can be avoided.

Construction of detention areas located between the existing S-332 B west and S-332 C detention areas and between the S-332 C and S-332 D detention areas were documented in the Corps' Supplemental EIS (2006) for IOP and built in 2007-2008. The Service's Biological Opinion (2006) documented additional operations guidelines for the operation of these detention areas that provided further protection for subpopulation C.

Since the construction of the original C&SF Project, and the SDCS, the ecological function of the study area in ENP and the associated southeastern Everglades, Southern Glades and Model Lands Basin (Figure 13) has been in decline. The construction of the numerous conveyance and drainage features has severely disrupted the hydrologic regime of the area, causing a transition from a wetland system characterized by overland sheet flow to one that moves water swiftly through conveyance features to point source discharge areas along Florida Bay. Infrastructure associated with drainage and conveyance features such as levees and canals and their operations has created drainage effects in some areas, and higher water stage levels in others. For example, Cape Sable seaside sparrow subpopulations B and C adjoin Taylor Slough (Figure 15), an area that has experienced substantial decline in flow and associated ecological function and is also a primary focus of the C-111 SC Project Phase 1. Conversely, Cape Sable seaside sparrow subpopulation D is located in an area that spans the C-111 and Aerojet Canals (Figure 14), and studies have indicated that this habitat area is experiencing longer hydroperiods than was naturally characteristic of the area.

Cape Sable Seaside Sparrow Critical Habitat

The Service has designated five units as revised critical habitat for the Cape Sable seaside sparrow (50 FR, 62736). Three of these critical habitat units described below, Unit 1 (subpopulation B), unit 2 (subpopulation C), and unit 3 (subpopulation D) are contained within the project study area. These critical habit units constituted the Service's best assessment, at the time, of the areas determined to be occupied at the time of listing that contained the PCEs essential for the conservation of the species that may require special management. In the critical habitat designation, the Service sought to accurately delineate only specific areas in which one or more of the PCEs are present. The units designated as Cape Sable seaside sparrow critical habitat in the project study area are: (1) marl prairie habitats that support sparrow subpopulation B and lie exclusively within ENP in the vicinity of the Main Park Road (State Road. 9336), between Shark River Slough and Taylor Slough; (2) marl prairie habitat that supports sparrow subpopulation C within ENP along its eastern boundary in the vicinity of Taylor Slough; (3) marl prairie habitats that support sparrow subpopulation D in the State-owned Southern Glades Wildlife and Environmental Area to the east of Taylor Slough and ENP. Table 4 details the area by unit determined based on Modbranch model grid mesh calculations and area delineated to meet the definition of critical habitat for the Cape Sable seaside sparrow. The following descriptions summarize baseline conditions in critical habitat Units 1, 2, and 3.

Unit 1 (Subpopulation B)

Unit 1 consists of 39,029 acres of marl prairie and lies exclusively within ENP. The unit is bounded on the south by the long hydroperiod Eleocharis-dominated wet prairie and mangrove zone just inland of Florida Bay, on the west by the sawgrass marshes and deepwater slough communities of Shark River Slough, on the north by the pine rockland vegetation communities that occur within ENP on Long Pine Key, and on the east by the sawgrass marshes and deepwater slough vegetation community of Taylor Slough. There is a continuous elevational gradient across the site, from the high elevations of the pine rocklands north of the unit down to the mangroves in the south. The area is bisected by the Main Park Road, which serves as the primary public access route from Homestead to Florida Bay. It is also bisected by the Old Ingraham Highway, which is an abandoned and partially restored roadway that historically provided access from Homestead to Florida Bay. Much of the western portion of this roadway was removed and restored to grade, but the eastern portions of the road, with its associated borrow canal and woody vegetation, interrupt the contiguity of the prairies within the eastern portion of this unit. Besides the road, borrow canal, and woody vegetation, which are not critical habitat, the area consists of one large, contiguous expanse of marl prairie that contains all of the PCEs for the sparrow.

When sparrows were first recorded in the area during 1974 to 1975 surveys, they were abundant and widespread (Werner 1975). Based on their limited mobility and dispersal capabilities and the presence and persistence of suitable habitat, the Service believes that the sparrows have occupied this locality since at least the time of listing. These same areas have remained occupied by sparrows since their discovery over 30 years ago. Consequently, the Service considered the unit to be occupied at the time of listing. The area is the largest contiguous patch of marl prairie east of Shark River Slough. It is currently occupied, and has consistently supported the largest sparrow subpopulation since 1992 (Pimm et al. 2002; Pimm and Bass 2006).

The natural characteristics of this area make it relatively immune to risk of flooding or frequent fires (Walters et al. 2000). Its location south of the high-elevation pine rocklands provides it a degree of protection from high water levels that do not occur within any other units. Within the southern portion of the greater Everglades watershed, water flows from north to south, with most water moving through Shark River Slough, and to a lesser extent through Taylor Slough. The pinelands block the southward flow of water across this area such that the primary influences on water levels are rainfall and overflow from the flanking sloughs. In addition, portions of the area occur on relatively high elevations and remain relatively dry. Consequently, this area is not easily flooded as a result of managed water releases or upstream events, and the high-water levels that may occur within other sparrow subpopulations are dampened by its relative position and topographic characteristics.

Similarly, the area is not particularly vulnerable to fires. It is not overdrained as a result of local hydrologic management actions, and the fire frequency is primarily influenced by natural ignition and managed prescribed fire. The public road that traverses the area could result in an increased likelihood of ignitions, but this has not occurred to date. In addition, the presence of both the Main Park Road and the Old Ingraham Highway within this unit provides human access greater than in any other unit and may allow better opportunities to manage both prescribed fires and wildfires such that they would pose a reduced risk to the persistence of the sparrow subpopulation.

Unit 2 (Subpopulation C)

Unit 2 consists of 8,304 acres of marl prairie habitat that lies exclusively within ENP in the vicinity of Taylor Slough, along the eastern edge of ENP. The unit consists of the prairies that flank both sides of the relatively narrow Taylor Slough. The area is bordered by the pine rocklands of Long Pine Key on the west and by isolated pine rocklands and the L-31W canal that runs along the ENP boundary to the east. It is bordered by an area of constriction in Taylor Slough that is closely flanked on both sides by forested habitats at the southern end and by the Rocky Glades, a region of thin marl soils and exposed limestone and sparse vegetation to the north. The area is bisected by the Main Park Road in the southern portion of the unit, but the remainder of the unit consists of contiguous marl prairies.

Although sparrows were discovered in the area in 1972 (Ogden 1972) the Service considered this unit to be occupied at the time of listing when it was listed on March 11, 1967, under the Endangered Species Preservation Act of 1967 (32 FR 4001). At the time of discovery, sparrows were found to be widely distributed and abundant in this area (Werner 1975). Based on their limited mobility and dispersal capabilities and the presence and persistence of suitable habitat, the Service believes that sparrows have occupied this locality since at least the time of listing. These same areas have remained occupied by sparrows since their discovery over 30 years ago. Following its discovery, the site was the location of some of the first intensive study of the sparrow's biology and its relationship to its habitat (Werner 1975). During the mid-1970s, sparrows were abundant at this site (Werner 1975), and surveys in 1981 estimated 432 sparrows in this area (Pimm et al. 2002). Since 1981, the sparrow subpopulation at this site has declined and has ranged from zero to 144 sparrows between 1995 and the present (Pimm et al. 2002; Pimm and Bass 2006). When sparrows were abundant in the area, the area was in a relatively dry condition, and water levels only rose above ground level for limited periods.

Beginning in 1980, a pump station, which was installed along the eastern boundary of ENP at the approximate location of the historic slough, was operated to increase hydroperiods in the area resulting in extended hydroperiods within the portions of the area downstream from the pump station (ENP 2005). Vegetation changed in this area from marl prairie to sawgrass marsh (ENP 2005), and sparrows ceased to occur in this area. At the same time, the northern portions of sparrow subpopulation C, above the pump station, continued to be overdrained as a result of the adjacent canal and a lowered water table in the agricultural lands immediately adjacent to ENP (Johnson et al. 1988; ENP 2005). In these overdrained areas, frequent fires impacted the habitat and resulted in reduced sparrow numbers (Pimm et al. 2002).

This area provides a contiguous expanse of habitat that is largely separated from other nearby subpopulations in an area that is uniquely influenced by hydrologic characteristics. The Taylor Slough basin is a relatively small system, and much of the headwaters of the Slough are cut off by canals and agricultural development to the east of ENP. Portions of this unit near the slough have deep soils (15.7 inches) (Taylor 1983) and support resilient vegetation that responds rapidly following fire (Taylor 1983; Werner and Woolfenden 1983).

Sparrows were reported to reoccupy burned sites in this region within 1 to 2 years following fire (Werner and Woolfenden). The unit contains the vegetation characteristics upon which sparrows rely, and most of the area currently experiences hydrologic conditions that are compatible with sparrows (one or more of the PCEs). This area remains heavily influenced by hydrologic management along the eastern boundary of ENP (ENP 2005). Portions of the area are also overdrained, resulting in the possibility of high fire frequency. The location of this unit relative to other sparrow subpopulations is significant in that it occurs in the center of the five sparrow subpopulations that occur east of Shark River Slough in the vicinity of Taylor Slough (subpopulations B through F). The habitat in this area most likely plays an important role in supporting dispersal among the eastern subpopulations, acting as a ''hub'' that facilitates dispersal in the region and recolonization of local areas that are detrimentally impacted.

Unit 3 (Subpopulation D)

Unit 3 consists of 10,806 acres of marl prairie vegetation in an area that lies on the eastern side of the lower portion of Taylor Slough. The majority of this area (9,973 acres) is within the Southern Glades Wildlife and Environmental Area, which is jointly managed by the District and FWC. The remaining 883 acres occurs within the boundary of ENP. The area is bordered on the south by the long hydroperiod Eleocharis vegetation and mangroves that flank Florida Bay, on the west by the sawgrass marshes and deepwater vegetation of Taylor Slough, on the east by long-hydroperiod Eleocharis vegetation and overdrained areas with shrub encroachment in the vicinity of U.S. Highway 1, and on the north by agricultural lands and development in the vicinity of Homestead and Florida City.

When sparrows were discovered in this area, they were widespread (Werner 1975). Based on their limited mobility and dispersal capabilities and the presence and persistence of suitable habitat, the Service believes that the sparrows have occupied this locality since at least the time of listing. These same areas have remained occupied by sparrows since their discovery over 30 years ago. The Service considered this unit to be occupied at the time of listing.

This is the easternmost area where sparrows occur and is the only subpopulation that occurs on the eastern side of Taylor Slough. It is consequently unlikely to be affected by the same factors (*e.g.*, large fires or extreme hydrologic conditions) that affect the other eastern subpopulations that lie primarily between Shark River Slough and Taylor Slough. This area is separated from other sparrow subpopulations by Taylor Slough, and the area immediately north of this subpopulation consists of agriculture and urban/suburban areas around Homestead and Florida City. These discontinuities in the landscape would tend to prevent fires from spreading from the area which supports sparrow subpopulations B, C, E, and F into the subpopulation D area.

Similarly, hydrologic conditions in this region are different than those that affect the other subpopulations because water levels are attenuated by Taylor Slough and influenced by flood protection and water supply infrastructure in the urban/agricultural areas to the north. Loss of suitable habitat and the sparrow subpopulation within this area would result in a reduction in the geographic range of the sparrow. The 1981 comprehensive survey of potential sparrow habitat estimated 400 sparrows within this region (Pimm et al. 2002). This was higher than any number of sparrows recorded in the area in recent years, and estimates have ranged from zero to 112 sparrows between 1992 and the present (Pimm et al. 2002; Pimm and Bass 2006).

The area currently contains all PCEs, but the majority of the area is dominated by sawgrass, which indicates a wetter-than-average condition within the spectrum of conditions that support marl prairie and sparrow habitat (Ross et al. 2006). The habitat in this area is divided by several canals that are part of the C–111 Basin. This canal system results in relatively altered hydrologic conditions in the region (ENP 2005) and causes extended hydroperiods during wet periods (Pimm et al. 2002). These factors influencing hydrologic conditions will continue to require management in the future.

Status of the species within the action area

Cape Sable Seaside Sparrow and Critical Habitat

The action area encompasses that portion of the seaside sparrow's range that includes the eastern subpopulations B, C, and D. The information in the Status of the Species section for these subpopulations addresses the status of the species and critical habitat within the action area, and is incorporated here by reference.

Factors affecting the species environment within the action area

The C&SF Project is a system-wide network of canals and water-control structures, located in south Florida and includes portions of several counties as well as ENP and Big Cypress National Preserve (BICY). The Corps and District operate the C&SF Project to achieve a variety of local and regional objectives including flood protection, water supply, and environmental benefits. Operations of the C&SF Project affect the hydrologic conditions of nearly all the wetland systems within southern Florida, including the habitat supporting the Cape Sable seaside sparrow. The Service's 1999 Biological Opinion on Test 7 of the Experimental Program, the C-111 Project, and the Modified Water Deliveries Project concluded that the Experimental Program jeopardized the continued existence of the Cape Sable seaside sparrow. It prescribed a Reasonable and Prudent Alternative (RPA) including a hydrologic management regime that would protect sparrow breeding by reducing water deliveries in western marl prairies and increasing water deliveries to eastern marl prairies that had been historically overdrained.

The Corps implemented Interim Structural and Operational Plan operations that achieved some of the benefits specified in the RPA, while meeting their requirement to maintain flood protection. In 2002, the Service issued an amendment to the 1999 Biological Opinion that adopted IOP as an RPA. Under IOP, hydrologic management provided reduced hydroperiods and reduced flows during the breeding season to sparrow habitat. Construction and operation of several detention areas adjacent to sparrow habitat in the eastern subpopulations increased hydroperiods in some overdrained habitats such as subpopulation C. Many other hydrologic operations throughout the C&SF system that routinely occur have resulted in changes to hydrologic conditions in and adjacent to sparrow habitat. Pre-storm and post-storm operations, testing of hydrologic management operations, and other similar activities conducted by the Corps and District have also affected hydrologic conditions within sparrow habitat mainly through alteration of the natural timing of wetting and drying events. Studies by (Sah et al. 2007) have documented a conversion of habitat type in subpopulation D, from shorter hydroperiod plant species to those indicative of longer hydroperiod conditions not preferred by sparrows.

Fire is a natural factor that affects marl prairies occupied by the sparrow and most sparrow habitats have burned at some point during the past 30 to 40 years. ENP, BICY, and the FWC have conducted prescribed burns within sparrow habitat. The Service has consulted with ENP on several prescribed fire plans. In addition, these agencies and the Florida Division of Forestry conduct wildfire suppression and management within sparrow habitat. In the short term, fires render sparrow habitat unsuitable for occupancy by sparrows because they remove the vegetation that sparrows rely upon for cover and refugia during periods when habitat is flooded. Following fire, vegetation normally begins to regrow rapidly and reaches pre-burn density and species composition about 2 years later. Sparrows do not regularly occupy burned areas for 2 to 3 years after fire (La Puma et al. 2007). ENP has conducted a prescribed fire in former sparrow habitat within the western marl prairies to facilitate habitat restoration. Within sparrow subpopulations, ENP has conducted wildfire suppression that was intended specifically to reduce potential impacts to sparrows and sparrow habitat within subpopulation B. Prescribed burns have also been conducted along the eastern ENP boundary to reduce the likelihood of human-ignited fires spreading into sparrow habitat near subpopulations C, E, and F. Fires, prescribed, natural, and human-ignited, have occurred within and in the vicinity of subpopulation D. Because fires reduce habitat suitability for up to 3 years, both prescribed fires and wildfires can have adverse effects on sparrow populations, but also may be necessary in the long-term for the maintenance of habitat (Taylor 1983; Pimm et al. 2002); Lockwood et al. 2003; Lockwood et al. 2005; LaPuma et al. 2007).

Changes in vegetation composition can result from changes in hydrologic conditions, changes in fire frequency, and management actions. Many areas of sparrow habitat have experienced vegetation change since monitoring was initiated. Overdrying that results from maintaining artificially low water levels within areas of sparrow habitat, such as those that occur along on the eastern boundary of ENP, are subject to woody vegetation encroachment, which reduces the suitability for sparrow occupancy. Extended hydroperiods and deep inundation that result from managed water releases in combination with wet-season rainfall have resulted in changes in vegetation from marl prairie to marsh species, resulting in reduced habitat suitability. Extended hydroperiods have resulted in vegetation changes in subpopulation D in the lower C-111 Basin.

Invasive and exotic species may also affect sparrows. Invasive plant species such as *Melaleuca*, Australian pine (*Casuarina* spp.), Brazilian pepper (*Schinus terebinthifolius*), and other woody species can become established in sparrow habitat and reduce habitat suitability. While limited information is available on the effects of invasive exotic animals on sparrows, species like the Burmese python have become established in sparrow habitat and may depredate sparrows. Additional information is needed to evaluate the magnitude of potential threat from invasive animal species.

Management of invasive woody plants has been conducted by ENP, FWC, and the District in and adjacent to sparrow habitat to reduce impacts of these species on sparrow habitat suitability. Herbicide treatment of large stands of exotic trees has reduced the spread of these species and has improved sparrow habitat in some areas. These invasive plant species regrow rapidly requiring continuing maintenance controls. Efforts to remove invasive exotic animals like the Burmese python have also been conducted, but to date these efforts have largely been opportunistic. Efforts are underway to design methods to capture pythons more systematically.

While direct physical disturbance to sparrow habitat and disturbance resulting from construction activities is limited because nearly all sparrow habitat occurs within ENP and other conservation lands, some construction activities have affected sparrows and sparrow habitat. Indirect effects of construction activities could include noise and vibration disturbance from heavy earth moving equipment and a general increase in human presence in the project area. Construction and maintenance of roads, canals, and levees near sparrow habitat can result in direct and indirect effects to sparrows through loss or degradation of habitat or disturbance. These activities within the action area are planned to occur at a distance well removed (minimum of 0.5 mile) from sparrow habitat areas.

Factors affecting critical habitat within the action area

Construction of the S-332B North and West Detention Areas and the associated pumps and operations schedule has resulted in wetter conditions and improved habitat quality in some areas, and protection of the desired water stage during the sparrow nesting window in subpopulation C critical habitat. Periodic fires continue to effect this subpopulation.

Cape Sable seaside sparrow subpopulation D critical habitat was affected when canal infrastructure for the C&SF Project and SDCS was constructed. In addition, in the 1960s, Aerojet-General Corporation built a plant, other infrastructure, and the Aerojet Canal, which is now within the subpopulation D critical habitat boundary, to supply NASA with solid fuel rockets. It was closed after NASA chose liquid fuel for the Saturn V program. When the Aerojet product was not selected for the Saturn project, the land and facilities were returned to the State, and are now managed by the District and the FWC as a nature preserve. The latest habitat studies available in subpopulation D (Sah et al. 2007) indicate that increased hydroperiod continues to influence the vegetation community towards longer hydroperiod species not preferred by the sparrow.

Data from studies (Sah et al. 2007) in Subpopulation B indicate the habitat remains primarily unaffected by factors that are causing discernable negative effects in other subpopulations.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action and its interrelated and interdependent activities on the eastern indigo snake and Cape Sable seaside sparrow and its designated critical habitat.

Eastern Indigo Snake

Factors to be considered

Factors considered in the analyses for effects of the action include the distribution of the geographic areas where disturbance will occur relative to the potential value of that area to eastern indigo snakes, the type of disturbance, the proximity of the action to natural areas outside of the project site but within the action area that may support indigo snakes, the timing of project activities relative to sensitive periods in the snake's life cycle, the duration of potential effects on indigo snakes and their habitat, and the operation and maintenance of the project.

The C-111 SC Project action area is characterized by marshlands, short hydroperiod marl prairies, hydric hammocks, mangroves, active and fallow row crop fields, orchards, canals and associated levees. There is sufficient cover on-site for eastern indigo prey. Eastern indigo snakes have been reported to use habitat near the project construction footprint (Figures 8 and 11). This information indicates that the entire site could be used by eastern indigo snakes although the quality of the habitat is varied.

The project construction activities would result in loss of cover, habitat, and associated prey, and disturbance may occur in the form of pedestrian, equipment, and vehicular traffic. Construction noise could disturb eastern indigo snakes where it exceeds ambient noise. Although personnel will be advised to avoid eastern indigo snakes, the operation of equipment in brushy, grassy, or otherwise vegetated areas, and along unconsolidated levee and canal banks where snakes may not be visible may result in direct injury or mortality. The construction of the Frog Pond Infiltration Basin, pump stations, canal plugs, and other infrastructure involves use of heavy equipment that may also injure or kill eastern indigo snakes.

Construction and maintenance activities are most likely to occur during daylight hours, the same time that eastern indigo snakes are active. This would increase risk of injury or mortality of eastern indigo snakes during construction activities.

The timing of construction is not known. It is likely that construction will occur year-round in at least some areas of the site. During construction, the infiltration basin will be scraped down to rock, and soils from the area will be used to construct the levees. Pump station construction will remove potentially occupied habitat. Additionally, canal plugs will be constructed by the placement of fill, from onsite levees as well as off-site spoil material, into the canals. These plugs could provide habitat for the eastern indigo snake and allow them to move between habitat on either side of the canal. If construction occurs during the nesting season (April through July), there could be potential for loss of eastern indigo snake nests on the levee.

Effects to the species may continue after construction in the form of operation and maintenance of the Frog Pond Infiltration Area. The operation of the infiltration basin will result in up to 90 acres of the infiltration basin being inundated for 80 days or longer at an average depth of 1 foot in an average rainfall year. These conditions could sustain a short hydroperiod wetland vegetative community. The remainder of the basin and levee would be covered with a dry grassy vegetative cover type which could be suitable eastern indigo snake habitat. The initial flooding of the site (as well as potential subsequent rehydrations after droughts) may disturb eastern indigo snakes that are present in the interior of the impoundment. Regular mowing of levees or other equipment and vehicle operation may also disturb snakes that have colonized the site post-construction. The operation and maintenance of the project features is anticipated to last approximately 50 years.

Eastern indigo snakes have been documented within the project's action area through sightings between 1951 and 1983. No more recent sightings have been documented. It is reasonable to assume that additional eastern indigo snakes are present on the site as it provides potential habitat for both eastern indigo snakes and their prey.

Analyses for effects of the action

The C-111 SC Project action area currently has raised embankments along the canals. These embankments provide higher ground for eastern indigo snakes and their prey to inhabit. The Service estimates that a total of approximately 12 acres of this habitat type could be affected by construction activities on embankments including the Aerojet Canal levee enhancement, project structures, plugs, and weirs. This represents a very small portion in relation to an individual indigo snake territory. In addition due to the distribution of these features in small impact areas across the action area, this effect would be even further minimized.

Potential effects to eastern indigo snakes may occur during initial construction of the Frog Pond Infiltration Basin, future operation and maintenance of the impoundment, and post-construction public use. By projecting a circular 185 acre territory atop the 530 acres construction footprint, we can estimate that as many as three eastern indigo snake territories could be present. Since the habitat is not optimal, this is, likely, an overestimate. The project construction activities and operations of the Frog Pond Infiltration Basin may cause eastern indigo snakes to leave the area, abandon den sites, and possibly miss foraging and mating opportunities. Individual eastern indigo snakes fleeing the area may be more vulnerable to road mortality, predation, and intraspecific aggression. Potential direct negative effects to the eastern indigo snake include injury or mortality from: (1) all construction activities including tree removal and burning; (2) vehicular traffic; and (3) initial hydration and subsequent rehydration of the infiltration basin. Other potential direct effects include loss of habitat and disruption of normal foraging, breeding, and dispersing behaviors. Potential indirect effects include mortality or injury from future operation and maintenance of the project via: (1) vehicular traffic, mowing and (2) changes in prey density within the project area and associated infrastructure as water levels fluctuate (including complete dry-out).

The eastern indigo snake is difficult to detect and quantify for the following reasons: (1) it has a wide-ranging distribution; (2) it has a patchy distribution within suitable habitat; (3) it has limited detectability due to use of burrows or holes for shelter; (4) there is likely unoccupied suitable habitat; (5) juveniles have limited detectability due to their affinity for thick vegetation; and (6) it may use cryptic sheltering areas that may be temporarily established during construction (*e.g.*, brush piles, equipment stockpiles, and dirt mounds). The lack of practical methods to survey, in conjunction with wide-ranging activity and use of a variety of habitat types makes it difficult to determine the exact number of eastern indigo snakes that will be affected by the action.

With up to three females potentially present in the Frog Pond Infiltration Basin alone, we assume that there could be up to three eastern indigo snake nests potentially on the site in any given year. Ms. Rebecca Bolt (2007), an eastern indigo snake researcher (Dynamac Corporation, Cape Canaveral, Florida), recognized that it is difficult to estimate the number of eastern indigo snake nests or eggs during any given year. Snake researchers at Kennedy Space Center, Florida have X-rayed female indigo snakes 2 consecutive years and found some to be gravid in both years, and others were gravid in 1 year and not another (Bolt 2007). Assuming every female could find a male and produce a clutch would be a conservative estimate. We could predict that as the quality of the habitat is reduced compared to native habitat, there may be an additional reduction in reproductive potential due to fewer resources (*e.g.*, prey and cover) and with fewer snakes, fewer nests would exist. There may also be a reduced likelihood of an eastern indigo snake finding a mate. However, we find it difficult to quantify these potential reductions and therefore, have assumed that there could be up to three nests on the site pre-construction. Each nest could have between 4 and 12 eggs or hatchlings (Moler 1992). The majority of construction operations will be confined to abandoned agricultural fields. Due to the small size of the site, it is likely that all eastern indigo snakes territories present on the site overlap the construction footprint. Construction would encompass the entire 530 acres Frog Pond Infiltration Basin site. We, therefore, would anticipate that all of the three nests present could be affected by construction activities. Since timing of construction is not known at this time, there is the potential for up to 3 eastern indigo snake nests to be damaged or destroyed during construction.

Direct effects

Direct effects are those effects that result from the proposed action (including the effects of interrelated and interdependent actions) and affect the species or its habitat.

Injury and mortality: It is difficult to determine the number of eastern indigo snakes (adults, juveniles, hatchlings, or eggs) that could be injured or killed by the project. Due to the nature of the proposed construction (*i.e.*, vegetation removal, debris piling and burning, canal filling or dredging, levee construction, scraping, grading, and initial hydration), the Service estimates that some of the eastern indigo snakes present at the time of the action could be adversely affected by the project. The flooding of the infiltration basin—whether the initial flooding or re-flooding after drought—has the potential to drown eastern indigo snakes nests and eggs, and inundate their burrows and other refugia. If a slow pumping rate resulting in a few inches of water per day is used, it should allow eastern indigo snakes to vacate the infiltration basin.

Eastern indigo snakes could be injured or killed during clearing and grubbing activities that will prepare the Frog Pond site for construction. Should there be a delay between clearing and grubbing and embankment construction, eastern indigo snakes could move back into those areas and be injured or killed as construction resumes.

We acknowledge a potential for additional mortality or injury of indigo snakes that may result from an increase in construction-related traffic. The travel routes in the vicinity of the project site include roads with light to moderate traffic. Since the life of the project is 50 years, injury and mortality of eastern indigo snakes could result from vehicular traffic generated during regular operations and maintenance post-construction. In addition, adverse effects could result from post-construction maintenance of the roads, levees, pump stations, and the Frog Pond Infiltration Basin itself (including vegetation management methods such as mowing, herbicide application, and physical removal). The mowing of embankments and levees has the potential to injure or kill eastern indigo snakes, and degrade habitat. In general, the District uses guidelines that specify that wildlife is not to be harmed during mowing; however, mowing does not usually occur until vegetation reaches 8 to 10 inches in height. At this height it may be difficult for equipment operators to observe and avoid snakes or other wildlife, although there have been no documented eastern indigo snake deaths from mowing activities.

Timing of construction will not be determined until a later date, therefore, we must assume that construction operations could also result in destruction of eggs or young.

<u>Habitat conversion and conservation</u>: The habitat that will be enclosed within the dykes of the infiltration basin can not be considered good eastern indigo snake habitat if there is lack of cover; however, the associated canal banks may be inhabited by eastern indigo snakes (Layne and Steiner 1996). The interior of the infiltration basin will continue to have habitat suitable for use by eastern indigo snakes during dry downs. Since the site will likely fluctuate in depth due to its small size, it is likely that some habitat will be available to eastern indigo snakes during operations. The infiltration basin is designed to capture excess water in the C-111 Canal that would normally be discharged through the S-197 during high intensity rainfall events. The availability of habitat in the infiltration basin suitable for use by the eastern indigo snake will be unpredictable and based on localized and regional rainfall events. Therefore, we must assume that the 530-acre footprint of the infiltration basin will have a reduced ability to support eastern indigo snakes.

Because this species is a habitat generalist, we anticipate that eastern indigo snakes will be present in most other land cover types as long as prey items and cover are adequate. For this project, we assume the entire action area for the project is potential habitat for the eastern indigo snake.

<u>Disturbance during construction</u>: The increased human presence on the site during construction along with the operation of construction equipment and vehicles may disturb eastern indigo snakes to the point they leave the construction area. This may result in missed foraging and mating opportunities and these individuals may be more vulnerable to predation and intraspecific aggression.

Indirect effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The indirect effects evaluated by the Service include injury and mortality associated with post-construction traffic by vehicles accessing the area for recreational purposes or monitoring, and reduced foraging opportunities associated with fluctuations in the prey populations due to impoundment drying or flooding. The indirect effects that the proposed action may have on eastern indigo snakes within the action area are discussed below.

<u>Injury and mortality</u>: Once construction is completed, additional vehicular traffic will access and operate in the area as a result of project monitoring, operations, and maintenance. The Service anticipates that a small number of indigo snakes may occupy the infiltration basin during operation and maintenance for the life of the project. Given the elevation of the infiltration basin dykes and the number of prey items that could become established in and around the infiltration basin, these snakes (especially snakes that bask on the levee roads during cooler weather) may be injured or killed from the operation of vehicles and equipment, although the precise number of snakes affected is difficult to determine. Similar effects may be realized in other impacted areas on the approximately 12 acres distributed throughout the remainder of the project study area associated with levee improvements, structures, plugs, and weirs.

Loss of prey: We expect that a prey base for the eastern indigo snake is available on the infiltration basin site. This prey base would continue to exist and may prefer the embankment and roads in the post-construction environment. The prey base may be ephemeral due to operations in the infiltration basin. High precipitation years may result in longer storage times for water collected in the infiltration basin. This longer storage time may reduce the amount of habitat available to eastern indigo snake prey. In addition, herbicide application to control exotic vegetation may occur as part of project maintenance. Prey (*e.g.*, insects, fish, amphibians, and some reptiles) may be vulnerable to herbicide application and may be killed, and therefore, not available to eastern indigo snakes as a result of these activities.

Cape Sable Seaside Sparrow

Construction effects

There will be physical disturbance to project construction sites and staging areas on District-owned lands adjacent to known Cape Sable seaside sparrow suitable habitat during construction of the Aerojet Canal improvements, C-110 plugs, S-198 structure, and other project features. These activities include work on levees and canals associated with excavation, possible blasting, construction, filling, hauling, and equipment operations. Soil disturbance, potential runoff and sedimentation, and potential spills (fuels, oils, chemicals, etc.) can be reasonably contained with the proper safeguards proposed as part of the project. In addition, ground-disturbing activities will not impact of any suitable sparrow habitat.

Noise associated with construction activities and vehicle and equipment activity, such as traveling to and from the project site, staging areas, and disposal areas outside the project site could disturb sparrows if it occurs adjacent to occupied habitat during the breeding season. However, disturbance to breeding sparrows is not anticipated due to the distance from project activities to historical nest sites.

Operations effects

Modbranch Model Evaluation Methodology

Investigation of both surface and groundwater flows were required to evaluate the effectiveness and flexibility of proposed C-111 SC Project features. Groundwater models are widely used as simulation tools for analyzing the subsurface systems including complexities in the horizontal and vertical extents. Surface and groundwater flow modeling was performed for the hydrogeologic system in the project study area footprint using a coupled ground- and surface-water model (Modbranch), developed to estimate ground-water flow and to simulate the hydrologic conditions in the surrounding area. Data on hydraulic conductivity, topography, subsurface layer elevations, sources and sinks, and boundary conditions was incorporated from the data available with the existing sub-regional Modbranch model. The model domain was placed within the project study area based on the realistic representation of the lithologies as defined by the existing sub-regional Modbranch model. The Modbranch model was configured to represent three representative one-year simulations, an average year (1978), a dry year (1989), and a wet year (1995). Data results were analyzed using metrics for the Cape Sable seaside sparrow for each subpopulation for the years analyzed and comparing the present condition results (Modbranch model run of Initial Operating Regime (IORLO2), hereafter referred to as "without-project" condition, to the with-project condition results (Modbranch model run of Initial Operating Regime with the recommended alternative 2Ds (IORLO2_2Ds), hereafter referred to as the "with-project" condition.

Hydrological effects

Pump stations will be constructed and operated in association with the Frog Pond Infiltration Basin, Aerojet Canal feature, the potential new S-198 structure, and the temporary pumping station that may be implemented as part of the Design Test. The pump stations will operate to divert or redistribute water from C111 and C-111E canals to freshwater and tidal wetlands during much of the year. This project is proposing the installation of several pump stations that connect to canals and discharge to an infiltration basin and spreader systems and then either directly or indirectly into wetlands. In addition, stage levels will be incrementally changed at several project structures to test the relationship of canal stage to potential effects on surrounding wetlands and agricultural lands. In some areas that are receiving additional flows and extended hydroperiod, such as sloughs, wetland, and estuarine habitats the proposed project is anticipated to increase habitat value for fish and wildlife and possibly sparrows in some locations. However, in some areas such as portions of the marl prairie habitat in sparrow subpopulation D which is currently experiencing extended hydroperiods, increased flows may further reduce suitable habitat conditions within this subpopulation.

Changing operations to raise stages at the S-18C and stage changes that may occur due to the potential construction and operation of S-198, may have beneficial effects on sloughs, wetland, and estuarine habitats that are receiving additional flows and extended hydroperiod, but may also be detrimental to sparrow subpopulation D and associated critical habitat by further lengthening hydroperiods which may result in vegetative shifts. In addition, construction and operation of the Aerojet Canal improvements could have detrimental impacts on sparrows within subpopulation D and associated designated critical habitat due to the effects of extended hydroperiods. The installation of plugs on the C-110 Canal could have a similar effect in retaining water levels within the surrounding marshlands and extending hydroperiods in portions of subpopulation D. Figures 18 and 24 graphically illustrate the hydroperiod changes that are predicted to occur with the proposed project as a result of the initial operations in an average year (1978) and a wet year (1995), as simulated by the Modbranch model. Minimal changes would occur during a dry year (1989) (Figure 21).

Cape Sable Seaside Sparrow Evaluation Criteria

The sparrow is selective in its life history requirements preferring a short hydroperiod marl prairie habitat that generally exists on the periphery, or within higher relief areas of more pronounced habitat features such as sloughs, marshes, and sawgrass flats. This very existence "on the edge" can create a condition where restoring more natural flow regimes (depth, timing, and duration) may affect the short hydroperiods necessary for sparrow habitat. This has necessitated an analysis of how to balance the wide range of wildlife and ecological needs as part of overall restoration efforts. The rational and methodology for performance criteria used to evaluate effects on the sparrow were previously described in the methodology discussion in this Biological Opinion and discussed in further detail in the Final FWCAR for this project (Service 2009b). Metrics were applied to Modbranch model output comparing the without-project condition to the with- project condition and are subject to the important assumption that the model is accurately characterizing project conditions as they will actually occur on the ground. The complications involved in this assumption were previously discussed; nonetheless, model outputs can be used to evaluate the trends anticipated in comparing alternatives. The performance criteria analyzed included the following for Cape Sable seaside sparrows and their designated critical habitat in subpopulations B, C, and D. The boundaries of these subpopulations are the same as their corresponding critical habitat boundaries:

Cape Sable Seaside Sparrow Nesting Criteria

1. Nesting criteria that examined temporal and spatial characteristics during the nesting season including acreage exhibiting a maximum continuous dry period of more than 80 days (inclusive of two sparrow nesting and fledging cycles) during the period from March 1 to July 15.
2. The area weighted average continuous dry period (days) in areas with a >80 day dry period from March 1 to July 15.
3. Analysis of acreage and duration of areas within habitat that had depth >20 centimeters during the period from March 15 to June 30 and including total acreage exceeding 30 continuous days.

Cape Sable Seaside Sparrow Habitat Criteria

1. Habitat maintenance criteria for preferred nesting grass species included analysis of acreage experiencing a 60 to 180-day discontinuous hydroperiod (total number of days water level is above ground level) during the calendar year.
2. The area weighted average hydroperiod (days) in areas with a 60 to 180-day hydroperiod.
3. Graphical analysis of habitat maintenance criteria to visually display project effects in the entire project study area.

Tables 5 through 7 and Figures 16 through 24 contain the results of all the above listed criteria analyses.

Cape Sable Seaside Sparrow Nesting Criteria Results

Cape Sable seaside sparrows can nest between February and July (Service 1983), but the majority of nesting occurs in the dryer spring season. Nests are constructed 17 to 21 centimeters off the ground (Lockwood et al. 2001) and preferentially in mixed marl prairie habitat. Pimm et al. (2002) estimates the nest cycle of sparrows to range from 34 to 44 days, when totaling the number of days required for all the nesting stages (egg laying, incubation, nestling, and fledgling). If water levels rise above the mean height of the nests during this period the sparrow will cease breeding (Lockwood et al. 1997; Lockwood et al. 2001; Basier et al. 2008; Cade and Dong 2008).

A measure of the potential for sparrow nesting success is the number of consecutive days between March 1 and July 15 that water levels are below ground surface. This range of dates incorporates most of the time-frame when sparrows have been observed nesting (Lockwood et al. 1997; Lockwood et al. 2001) and is an indirect measure of the number of days potentially available for sparrow courtship and nesting (Van Lent et al. 1999; Lockwood et al. 1997; Lockwood et al. 2001). Modeling of sparrow reproductive potential (Pimm and Bass 2001, Walters et al. 2000) supports the general recommendation for evaluation of nesting condition availability, which states that 40 consecutive days for 8 out of 10 years is considered favorable for sparrow population persistence, 40 days for 7 out of 10 years is considered borderline for persistence, 80 consecutive days for 8 out of 10 years is considered very favorable, and 80 days for 7 out of 10 years is favorable. For purposes of this evaluation nesting criteria 1 analyzed the number of ac within each individual sparrow subpopulation meeting greater than an 80-day continuous dry period (water level below ground), between March 1 and July 15 during each year analyzed. A secondary related metric was nesting criteria 2, the area weighted average number of days exceeding the 80-day threshold during the same time period.

The results of these nesting criteria analyses for subpopulations B and C indicate that minimal effects are expected to occur in the three representative modeled years (Tables 5 and 6). Data for subpopulation D indicate that 237 acres (2 percent of habitat) in the average (1978) year and 646 acres (6 percent of habitat) in the wet (1995) year will be affected by the project and no longer meet the >80 day continuous dry period criteria (Table 7) but will still be >40 days. The model indicates no change in the dry (1989) year in subpopulation D. In addition, area weighted calculations of the average maximum continuous dry period in subpopulation D habitat indicate that the hydroperiod range will exceed the >80 day criteria in all years analyzed, as they currently do without the project, even though small reductions are indicated (132 to 123 days in an average year and 115 to 106 days in a wet year). Furthermore, modeling shows that this metric will continue to exceed 100 days as it does in the current condition in all modeled years (Table 7) indicating that the overall effect of the project in subpopulation D on nesting will be minimal.

Although the analyses above indicate minimal changes from current without-project conditions, these effects on nesting criteria need to be considered along with other parameters. The area weighted calculations of average maximum continuous dry period in all acreage for subpopulation B (nesting criteria 2) illustrate that in an average year (1978) in both the with and without-project conditions, this subpopulation averages 85 days and in a wet year (1995) it averages 52 continuous dry days during the breeding season compared to the same data in subpopulation D, which averages 119 (with-project) to 128 (without-project) days (1978) in an average year and 100 (with-project) to 112 (without-project) days in a wet year (1995).
This analysis of the model results suggests that subpopulation B is generally wetter than subpopulation D. However, sparrow subpopulation B has been documented to support the largest self-sustaining subpopulation over the recent past, whereas subpopulation D has struggled

to persist (Table 3). This comparison may indicate other factors are contributing to the overall habitat suitability or nesting success in subpopulation B or that the model does not accurately reflect existing habitat conditions.

The last nesting metric evaluated was nesting criteria 3 described above that analyzes the number of ac within each individual sparrow subpopulation in which the maximum water depth (above ground level) exceeded 20 centimeters for at least 1 day during the period from March 15 to June 30 during any year analyzed (average, dry, and wet). Another metric was evaluated as part of nesting criteria 3; that is the total ac that exceeded the 20 centimeters criteria for more than 30 days. This metric is consistent with the primary constituent element (4) Hydrologic Regime, published for the sparrow in the critical habitat designation in 50 FR, 62736 and will be discussed further in the critical habitat effects section of this Biological Opinion.

Calculated metrics for areas with depths >20 cm between March 15 and June 30 showed that the modeled effects of the project in relation to the without-project condition are small. That is, 0.2 percent of total acreage in all subpopulations would experience spikes in high water as compared to current conditions that have the potential to flood nests. Nests occur between 17 to 21 centimeters above ground (Pimm et al. 2002; Lockwood et al. 2006; Basier et al. 2008; Lockwood et al. 2008) with nests occurring higher and higher during the nesting season as water levels rise. Therefore, this metric, when measured as a 1-day spike gives an indication of relative risk of nest flooding. For this project the risk is considered low. Given that a small percentage of the acreage is occupied with nests, we do not anticipate any nests to be flooded as a result of this action.

In summary, no appreciable effects on subpopulations B and C are anticipated and only minimal effects on subpopulation D are indicated based on the nesting criteria metrics analyzed with Modbranch data. These minimal effects could result from minor reductions in the quality (between 40 and 80 days) and quantity of available suitable nesting habitat conditions or the potential to flood active nests on no more than 0.2 percent of the acreage in all subpopulations. If these effects occurred when and where sparrows were nesting, these impacts could result in nest abandonment or nest failure. The Service considers this risk unlikely.

Cape Sable Seaside Sparrow Habitat Criteria Results

Cape Sable seaside sparrow nesting habitat studies indicate the sparrow shows a preference for nest sites that provide specific vegetative characteristics (Basier et al. 2008). Nests are built where at least 25 to 50 percent of the vegetative litter is moderately high. The presence of specific grasses such as *Muhlenbergia filipes*, *Schizachyrium rhizomatum*, and *Schoenus nigricans* also appear to be cues for nest placement. These grass species show an optimal preference for sites that characteristically have a discontinuous hydroperiod (water above ground level) in the range of 60 to 180 days. Habitat with average hydroperiods longer than this range are generally dominated by species such as sawgrass. The habitat criteria 1 metric which was applied for this analysis was the number of acres within each sparrow subpopulation meeting the 60 to 180-day discontinuous hydroperiod window during each year analyzed. A secondary related metric (habitat criteria 2), was the area-weighted average number of days meeting the 60 to 180-day discontinuous hydroperiod window. These metrics are consistent with the primary constituent element (2) Herbaceous Vegetation, published for the sparrow in the critical habitat designation (50 FR, 62736), which will be discussed in the critical habitat effects analysis.

The most evident results from the Modbranch output data was the habitat maintenance criteria for preferred nesting grass species that included analysis of acreage experiencing a 60 to 180-day discontinuous hydroperiod during the calendar year (total number of days water level is above ground level). The analysis performed for subpopulation B indicated that the proposed project would have no apparent effect on this metric. The analysis also showed for subpopulation B that this hydroperiod range occurred on 25,169 acres (64 percent of total acreage) in both the with- and without-project scenarios during an average year (1978). The same metric showed that for both the with- and without-project scenarios in the dry year (1989) 2,304 acres (6 percent) and in the wet year (1995) 313 acres (1 percent) met the hydroperiod range for discontinuous hydroperiod (Table 5). Based on the continued health of subpopulation B, this provides additional support for the assumption that hydroperiod during the average year is particularly important in terms of its influence on sustaining suitable sparrow habitat conditions.

Table 6 details the Modbranch analysis for the habitat criteria based on the 60 to 180-day discontinuous hydroperiod for sparrow subpopulation C. Table 6 shows that the project may benefit habitat in subpopulation C during an average year (1978), as an additional 1,442 acres in this habitat will experience a 60 to-180 day discontinuous hydroperiod. This represents a 17 percent increase in total available habitat meeting the metric compared to the without-project condition. The area weighted average hydroperiod metric shows a minimal net increase of 3 days from 95 to 98 days with the project, which is not anticipated to result in any shifts in vegetative composition. The analysis of the model output for this subpopulation in a dry year (1989) indicates no apparent effect of the project. Whereas, data for the wet year (1995) reveals that a total of 1,320 acres in subpopulation C which currently experiences a 60 to180-day discontinuous hydroperiod in a wet year, will not with the project. This represents a 16 percent decrease in total available habitat over current conditions in a wet year compared to the without-project scenario. It is interesting to note that more habitat meets the 60 to180-day criteria in a wet year (1995) than an average year (1978) (5,771 acres and 3,240 acres, respectively) in the without-project scenarios (Table 6). Whereas the with-project scenario indicates that 4,451 acres will meet the hydroperiod criteria in a wet year (1995) and 4,682 ac in an average year (1978). The area weighted average hydroperiod (days) shows a net increase of 15 days from 135 to 150 days with the project in a wet year (1995). Given that this analysis reflects a dynamic response of water management in subpopulation C in wet, average, and dry years and that the area-weighted average hydroperiod in a wet year will increase, yet remain within the 60 to 180-day window, large changes in habitat conditions in subpopulation C are not anticipated.

The modeling output for subpopulation D indicates a more complex relationship, especially for the acreage meeting a 60 to 180-day discontinuous hydroperiod (Table 7). The without-project model output indicates that part of this subpopulation is currently impacted by long hydroperiods which can cause and has caused the conversion of shorter hydroperiod preferred habitat to longer hydroperiod sawgrass. Subpopulation D is located in an area adjacent to proposed project features that are likely to result in increased hydroperiods (stage and duration) (Figures 16 to 24). This metric reveals that the project may be detrimental to sparrow habitat in subpopulation D during an average year (1978). A potential reduction of 1,606 ac of currently suitable subpopulation D habitat represents a 15 percent decrease in total available habitat in an average year compared to current conditions. The area weighted average hydroperiod (days) shows a net increase of 29 days from 124 to 153 days with the project. The data for subpopulation D in the dry year (1989) analysis indicates no apparent effect of the project.

Data for the wet year (1995) reveals that the project may negatively affect subpopulation D. A reduction of 1,421 acres of suitable habitat may occur in the acreage currently experiencing a 60 to 180-day discontinuous hydroperiod in a wet year, representing a 13 percent decrease in total available habitat compared to current conditions. The area weighted average hydroperiod (days) for the wet year (1995) shows a net decrease of 17 days from 154 to 137 days with the project. This decrease is, however, due to the increased acreage in habitat which now exceeds the 180 day criteria, resulting in a reduced acreage amount that is used to calculate the area weighted average hydroperiod remaining in the hydroperiod window.

Table 8 provides an additional analysis of the 60 to 180-day discontinuous hydroperiod during an average model year (1978) for subpopulation D. This table displays the without-project and with-project hydroperiod, in average number of days, separated by incremental ground surface elevations within the habitat boundary. The acreages within each incremental elevation zone are also shown. For all subpopulation D acreage (10,806 ac) tabulated in Table 8, 10,341 acres, or 96 percent of the total, fall within the 60 to 180-day hydroperiod window in the without-project scenario, but only 6,647 acres, or 62 percent, will meet this window in the with-project scenario. Although 60 to 180 days is optimal, sparrow habitat can be found in up to 270 day hydroperiods. Table 8 illustrates that hydroperiod changes in an average year in subpopulation D would increase hydroperiods up to 183 days across 90 percent of the subpopulation and up to 192 days across 98 percent of the subpopulation. This analysis demonstrates that although hydroperiods may lengthen in some locations, vast changes in habitat are not anticipated in average years.

The Initial Operation Regime with-project model scenario was analyzed at a centrally located model cell at elevation 2.1 NGVD29 with a trigger elevation of 2.4 (adding 10 cm) during the sparrow nesting period (February 1st thru July 15th). This trigger cell provided feedback when the trigger elevation was exceeded to cease operations at S-18C and S-198 that were backing up water into subpopulation D habitat. The 2.1 ft elevation zone represents the "trigger cell" elevation in subpopulation D that will be used to limit project operation stage changes and minimize effects on the Cape Sable seaside sparrow. The 2.1 ft elevation zone is located at an elevation within subpopulation D above which the majority of most recent nesting activity has occurred. The additional 10 cm is considered to be a reasonable minimum water depth that sparrows will tolerate without abandoning nest sites and is well within the 20 cm criteria used as part of PCE 4. Table 8 illustrates a shift in 4,159 acres above the 180 day criteria with the project for habitat below 2.1 ft NGVD29 elevation. Finally, 1,802 acres that, in the without-project scenario, were below the 60 day hydroperiod criteria fall within the 60 to 180-day window in the with project scenario indicating a potential benefit due to habitat improvement. However, during an average year, the model output indicates a potential reduction of 4,159 ac of suitable habitat which would be offset slightly by the potential gain of 1,802 ac of habitat for a net potential loss of 2,357 ac (22 percent) of habitat in subpopulation D.

Cape Sable Seaside Sparrow Spatial Analysis

The previous analyses and discussion of project effects on sparrow habitat illustrates the complexity involved in assessing the project effects on individual subpopulations and evaluating the overall effects of the project on a landscape scale. The Service reiterates that the previous analyses were conducted based on model output and subject to concerns expressed with modeling in other sections of this document. Calculations of acreages affected in individual sparrow subpopulations using various metrics provide insight into the volume of perceived effects but do not reveal the spatial distribution of those effects within the subpopulations and within the project study area as a whole. The previous analyses illustrated that project effects are principally related to the 60 to 180-day discontinuous hydroperiod in subpopulation D. The Service conducted additional analyses using Graphical Information System (GIS) software to illustrate the spatial relationships of this metric. Figures 16 and 17 display the model results for the average year (1978), Figures 18 and 19 for the dry year (1989), and Figures 20 and 21 display the results for the wet year (1995). Two illustrations are provided for each year modeled to depict the spatial extent of hydroperiod ranges throughout the project study area for the without-project and with-project conditions.

For Cape Sable seaside sparrow subpopulation B, the spatial analysis revealed no discernable effects of the proposed project on habitat suitability for any of the years modeled. In addition, no detectable project effects were evident from the spatial illustrations generated for the dry year (1989) in any sparrow subpopulation or in the project study area (Figures 18 and 19). The following discussion will therefore be focused on the graphical representations for the average year (1978) (Figures 16 and 17) and the wet year (1995) (Figures 20 and 21) for the 60 to 180-day discontinuous hydroperiods.

These figures reveal a multitude of potential project effects and permit a more detailed investigation of the effects indicated by the model output. Following is a list of some notable potential project effects.

1. Comparison of Figures 16 and 17 indicates that in an average year (1978), subpopulation C will experience an increase in acreage exhibiting the desired 60 to 180-day discontinuous hydroperiod (indicated by green shading) in the southern portion of the habitat which currently exhibits moderate sparrow use. This appears to be the result of currently dryer habitat moving into the desired hydroperiod window. However, in a wet year, this same area appears to be too wet in the with-project condition in a comparison of model output in Figures 20 and 21.
2. Comparison of Figures 16 and 17 indicates that in an average year (1978), subpopulation D will experience a decrease (indicated by the expansion of blue shaded area) in acreage exhibiting the desired 60 to 180-day discontinuous hydroperiod (indicated by green shading), primarily in the southeastern portion of the habitat. This portion of subpopulation D has recently exhibited limited use by sparrows. A northern segment of subpopulation D along the C-111 Canal that is indicated in the without project condition to be too dry will be within the desired hydroperiod window in the with-project condition in an average year based on model output; potentially benefiting this area.

3. Comparison of Figures 20 and 21 indicates that in a wet year (1995), almost all of subpopulation D west of the C-111 Canal will have a hydroperiod exceeding the desired 60 to 180-day discontinuous hydroperiod (indicated by the expansion of blue shaded area) in the with-project scenario.
4. Comparison of Figures 16 and 17 indicates that in an average year, there is the potential for sparrow habitat to expand in the project study area outside of the current subpopulation D area to the north and east. This is based on the modeled occurrence of the desired 60 to 180-day hydroperiod and needs to be further evaluated for other habitat characteristics needed by the sparrow. A comparison of model output of a wet year (1995) (Figures 20 and 21) indicates that the with-project condition also appears to allow for additional potential habitat expansion in this area.

In summary, Figures 16 and 17 provide an overall view of the discontinuous hydroperiod that will occur throughout the project study area as indicated by the model. Areas depicted in various shades of green fall within the 60 to180-day hydroperiod window that is optimal for maintenance of sparrow habitat. Decreases in available habitat due to the project in the with-project condition appear to be concentrated within sparrow subpopulation D in modeled average and wet years. Other areas are indicated by the model with-project condition, both within and outside sparrow subpopulations C and D in average and wet years, which may be within the desired hydroperiod window and therefore could be beneficial to expansion of sparrow habitat.

Cape Sable Seaside Sparrow Critical Habitat

This Biological Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In evaluating project impacts to designated critical habitat for the Cape Sable seaside sparrow, potential adverse impacts to PCEs were examined using a hydrological model (Modbranch) for a comparison of without-project and with-project scenarios. The Modbranch model was developed to simulate three individual years intended to be representative of average (1978), dry (1989), and wet (1995) conditions. The evaluations compare without-project conditions against the with-project conditions for each of the referenced single-year simulations within critical habitat for the sparrow. The PCEs for the Cape Sable seaside sparrow were described in the (50 FR 62736), and discussed previously in this Biological Opinion. The PCEs include:

<u>PCE 1: Calcitic Marl Soils</u>

Marl soils are characteristic of the short-hydroperiod freshwater marl prairies of the southern Everglades and support the vegetation community on which sparrows depend. They also result from specific hydrologic conditions that are characteristic of the marl prairie. Presently, soils in the marl prairie landscape within sparrow habitat vary in physical and chemical characteristics due to the variation in topography, hydrology, and vegetation (Sah et al. 2007). There currently are no methodologies upon which to evaluate project operations on soils, we therefore rely on our hydrologic analyses that provide for marl prairies as surrogates for soils analyses.

PCE 2: Herbaceous Vegetation

Greater than 15 percent combined cover of live and standing dead vegetation of one or more of the following species: Muhly grass, Florida little bluestem, blacktopped sedge, and cordgrass. These plant species act as cover and substrate for foraging, nesting, and normal behavior for sparrows during a variety of environmental conditions. Many other herbaceous plant species also occur within sparrow habitat (Ross et al. 2006), and some of these play important roles in the life history of the sparrow (Sah et al. 2007).

Previous discussion provided the Service's justification for the use of the 60 to 180-day discontinuous hydroperiod metric to measure optimal conditions for maintenance of sparrow habitat and for the above plant species detailed in this PCE. Tables 5 through 7 document the results of Modbranch hydrologic model simulations for average (1978), dry (1989), and wet (1995) years for the without project and with project scenarios for subpopulations B, C, and D, which coincide with their associated critical habitat.

Based on this metric, all 39,029 ac of subpopulation B critical habitat would be unaffected by the proposed project. Our analysis indicates that subpopulation C critical habitat will experience an increase of 1,442 ac (+17 percent of total critical habitat acreage) meeting the optimal 60 to 180-day hydroperiod window in an average year, would be unaffected in a dry year, and would experience a decrease of 1,320 ac (-16 percent) meeting the same hydroperiod window in a wet year. Overall, this analysis indicates that dramatic changes in vegetative composition are not expected to occur as a result of the proposed project within subpopulation C critical habitat. Our analysis indicates that subpopulation D critical habitat would experience a decrease of 1,606 acres (-16 percent) meeting the optimal 60 to 180-day hydroperiod window in an average year, would be relatively unaffected in a dry year (increase of 20 ac), and would experience a decrease of 1,421 acres (-13 percent) meeting the same hydroperiod window in a wet year. In summary, the analysis indicates that, based on model output, subpopulation D critical habitat is likely to experience a reduction in optimal vegetation communities due to changes in hydrology caused by the proposed project.

Hydrologic conditions that occur in an average year are the most influential in effect on the resultant vegetation community. The effects of the project as indicated by this metric in an average year based on Modbranch simulations on critical habitat for subpopulation B will be indistinguishable, slightly beneficial for subpopulation C, and detrimental to subpopulation D.

PCE 3: Contiguous Open Habitat

Sparrow subpopulations require large, expansive, contiguous habitat patches with few or sparse woody shrubs or trees. The constituents of this PCE are largely predicated on a combination of hydroperiod and periodic fire events. Fires prevent hardwood vegetation from invading these communities and prevent the accretion of dead plant material, both of which decrease the suitability of this habitat type for Cape Sable seaside sparrows. Implementation of the proposed project could extend hydroperiods causing a minimal effect on the occurrence of natural fires in the area. Establishment of woody vegetation in marl prairie habitat is often complicated by a variety of factors including hydroperiod that can favor woody vegetation preferring longer or shorter periods of inundation, land elevation changes such as levees, and nutrient loading. The proposed incremental project operation changes are intended control excessive hydroperiod changes thus minimizing significant project related changes in woody vegetative composition. Appreciable changes in the PCE within each critical habitat area are not anticipated.

PCE 4: Hydrologic Regime–Nesting Criteria

In order to maintain suitable vegetative composition conducive for successful nesting, it is important that water depth, as measured from the water surface down to the soil surface, does not exceed 7.9 inches (20 cm) for more than 30 days during the period from March 15 to June 30 at a frequency of more than 2 out of every 10 years. Water depths greater than 7.9 inches (20 centimeters) during this period will result in elevated nest failure rates (Lockwood et al. 2001; Pimm et al. 2002). If these water depths occur for short periods during nesting season, sparrows may be able to re-nest within the same season. These depths if they occur for sustained periods (>30 days) within sparrow nesting season, will reduce successful nesting to a level that will be insufficient to support a population if they occur more frequently than 2 out of every 10 years. This PCE was also discussed previously in the context of its importance as an indicator of hydrologic conditions that would prevent flooding sparrow nests, maintain hospitable conditions for sparrows occupying these areas, and generally support the vegetation species that are essential to sparrows

Tables 5 through 7 document the results of Modbranch hydrologic model simulations for average (1978), dry (1989), and wet (1995) years for the without project and with project scenarios for critical habitat associated with subpopulations B, C, and D. Based on this metric, sparrow subpopulation B and subpopulation C critical habitat are unaffected by the proposed project in any year simulated. This analysis indicates that Sparrow subpopulation D critical habitat is also unaffected except in a simulated wet year (1995) when 36 acres (0.3 percent) will exceed the depth and duration during the designated time period criteria for this PCE.

In summary the analysis shows that overall effects of the project as indicated by this metric and based on Modbranch simulations on critical habitat for subpopulation B, C, and D will be indistinguishable from current conditions. The minor effects indicated in a wet year in subpopulation D critical habitat, would not be expected to occur more frequently than 2 out of every 10 years.

Interrelated and Interdependent Actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. The Service has addressed all interrelated and interdependent actions in the analysis of effects above. The action under consideration in this consultation is phase 1 of a potential 2-phased action. Although the Service supports implementation of Phase 2 of the C-111 SC, it is uncertain as to whether that action will be conducted. If it is, separate consultation pursuant to section 7 of the Act may be necessary.

Therefore, there are no interdependent or interrelated actions associated with the proposed action, that have not already been analyzed under the effects of the action, that are expected to affect Cape Sable seaside sparrows or their designated critical habitat.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they will require a separate consultation pursuant to section 7 of the Act.

Eastern Indigo Snake

Conversion of surrounding lands that currently support indigo snakes to residential uses that would support less eastern indigo snakes would be the most likely cumulative effect on the species, but only if no wetlands were impacted (*i.e.*, no Federal permit was required). Projects with wetland impacts would be evaluated through a separate consultation pursuant to section 7 of the Act. The primary threat today to the eastern indigo snake is habitat loss and fragmentation due to development (Lawler 1977; Moler 1985a). Besides loss of habitat, residential developments also increase risk of harm to eastern indigo snakes in the interface areas between urban and native habitats because it increases the likelihood of snakes being killed by property owners and domestic pets. Increased traffic associated with development may also lead to increased eastern indigo snake mortality. Given that the north side of the project action area is urban and agricultural, there will be additional development pressures on the remaining lands to the south in the future. However, jurisdictional wetlands are prominent in this area which would require a federal permit for development and subsequent review pursuant to the Act. Therefore, the Service does not anticipate any appreciable cumulative effects to the eastern indigo snake.

Cape Sable Seaside Sparrow

Within the action area, essentially all of the lands supporting Cape Sable seaside sparrows and their designated critical habitat are State, or federally-owned and managed lands. Activities that may occur in the action area, but outside of State or federally-owned lands, have the potential to affect sparrow habitat primarily through changes in hydrology or water quality. However, water management to meet flood protection requirements, water supply, and restoration are permitted by the Corps and therefore have a Federal nexus upon which section 7 consultation pursuant to the Act may be necessary. In addition, these water management efforts must meet State and Federal water quality requirements. The Service is unaware of any changes in water management that may affect sparrows or their critical habitat therefore, within the action area that would not undergo section 7 review under the Act.

The 30,000-acre Southern Glades Wildlife Management Area is managed cooperatively between the District and FWC and is located in Miami-Dade County adjacent to the C-111 Canal between ENP and U.S. Highway 1. The area was acquired to protect wildlife habitat, including the Cape Sable seaside sparrow, and as part of Everglades restoration. Activities that can and have occurred on these lands include hydrologic/habitat restoration, exotic plant and animal control, prescribed burns, public use, environmental education, and mitigation. In accordance with the Florida Statutes Chapter 373.1395, lands acquired by the District shall be managed to "ensure a balance between public access, general public recreational purposes, and restoration and protection of their natural state and condition." Generally, these actions would be consistent with the maintenance and restoration of sparrow habitat.

Therefore, the majority of potential affects to Cape Sable seaside sparrows and their habitat, including designated critical habitat, are anticipated to be related to future Federal actions that will require a separate consultation under the Act. Therefore, the Service does not anticipate any appreciable cumulative effects to Cape Sable seaside sparrows or their designated critical habitat.

CONCLUSION

After reviewing the current status of eastern indigo snake, Cape Sable seaside sparrow and its designated critical habitat, the environmental baseline for the action area, the effects of the proposed C-111 SC Project Phase 1 and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the eastern indigo snake and Cape Sable seaside sparrow, and is not likely to destroy or adversely modify Cape Sable seaside sparrow designated critical habitat.

Eastern Indigo Snake

Eastern indigo snakes are likely to occur in the project area in low densities. Although the Corps will implement measures to minimize the risk to indigo snakes from construction activities, indigo snakes may be hidden in pockets of vegetation, rock crevices and other places where they may not be evident and therefore susceptible to unintentional injury or mortality due to construction. We anticipate harassment of up to 6 indigo snakes from construction disturbance, flooding and associated project operations, the destruction of no more than 1 nest, and no more than 1 indigo snake would be killed or injured as a result of construction activities. Construction and operations are not anticipated to result in any appreciable loss of habitat and indigo snakes are expected to occupy the project area in the same densities as before the action. The loss of one snake is not anticipated to appreciably reduce the number, reproduction or distribution of eastern indigo snakes which are found throughout all of southern Florida in a variety of habitats.

No critical habitat has been designated for the eastern indigo snake; therefore, none will be affected.

Cape Sable Seaside Sparrow

The C-111 SC Project is not anticipated to result in the direct mortality or disturbance of sparrows from construction activities, nor would construction activities result in the loss of suitable sparrow habitat. In addition, operations are not anticipated to directly kill or injure any sparrow and would not result in the flooding of active nests. Therefore, direct injury or mortality of sparrows is not anticipated from project construction or operations.

Operations will, however, lengthen hydroperiods and therefore degrade suitable sparrow habitat. Model output indicates subpopulation B will be relatively unaffected by changes in hydroperiods. Therefore, we do not anticipate any change in habitat quality or impacts to the sparrow subpopulation in this location.

Subpopulation C will experience increased hydroperiods beyond the optimal condition (60 to 180 days) on 1,320 acres during a wet year, but would experience improved hydroperiods on 1,442 acres during an average year and would experience no change in hydroperiods in a dry year. Since hydroperiods are influenced by water depth and topography, the same areas that may experience increased hydroperiods during wet years are the same areas that would experience improved hydroperiods in average years. When average and dry years are combined they are expected to occur more frequently than wet years. Therefore, the increased hydroperiods in a wet year are not anticipated to be sustained over a long enough period of time to result in loss of suitable habitat. As a result, the population of sparrows in subpopulation C is not anticipated to be impacted by the proposed action.

Whereas, extended hydroperiods in subpopulation D would occur across 1,606 acres in an average year and 1,421 acres in a wet year. There would be no appreciable change in hydroperiods in a dry year. The overlap in extended hydroperiods in wet and average years indicates likely sustained increased hydroperiods that would influence vegetative structure important to the sparrow. The majority of sparrows are found in habitats containing Muhly grass, Florida little bluestem, and black-topped sedge. These grasses act as cover and substrate for foraging, nesting and normal behavior during a variety of environmental conditions (Pimm 2002). Ross et al. (2006) compared percent of census locations with observed sparrows to vegetation census plots from which hydroperiods were inferred. The greatest percent of sites where sparrows were observed (between approximately 37 and 50 percent of the sites) occurred in inferred hydroperiods ranging from approximately 90 to 180 days where the above listed grass species were observed. However, suitable grass species and sparrows (at approximately 35 percent of the sites) were observed in inferred hydroperiods ranging between 180 and 210 days. Therefore, although the Service assumes the optimal conditions for sparrows and their suitable habitat occurs within a 60- to 180-day hydroperiod, sparrows and suitable vegetation can be found in areas receiving longer hydroperiods, but in less than optimal conditions.

Occupied habitat by sparrows is dominated by muhly grass and is relatively species rich, and habitat that is not occupied by sparrows is dominated by sawgrass and is not species rich (Pimm et al. 2002). In addition, sparrows select nest sites that have high muhly grass, Florida little bluestem, and black-topped sedge coverage, as well as high effective and maximum vegetation heights. Higher sparrow densities are associated with high coverage of muhly grass and litter as well as high vegetation heights (Pimm et al. 2002). Successful nests are more often associated with high muhly grass coverage and high vegetation heights. Thus availability of these habitat components relates to higher sparrow numbers and fecundity of breeding individuals. Whereas large areas of dense sawgrass provide little open space for foraging near the ground (Pimm et al. 2002). These areas also typically support fewer other plant species, including the smaller-stature sedges where sparrows typically place their nests. However, the presence of some sawgrass is desirable because sparrows use the seedheads to defend their territory and to scan for predators. In contrast to the varied role of sawgrass, muhly grass always seems to be selected by sparrows. Higher percent cover of muhly grass is associated with site occupancy, higher sparrow density, and successful nests (Pimm et al. 2002).

Table 8 illustrates that all of subpopulation D will experience increased hydroperiods and that approximately 1,606 acres would extend beyond the optimal conditions of 180 days. However, none of the acreage currently below a 180-day hydroperiod would extend beyond a 192-day hydroperiod, with the greatest change (875 acres) being from 152 to 183 days. These increased hydroperiods would degrade sparrow habitat by potentially altering the vegetative density or diversity of preferred grasses (muhly grass, Florida little bluestem, and black-topped sedge) which would likely result in changes in how sparrows use that habitat. However the Service does not anticipate a complete loss of preferred grasses from the site and there would not be a complete conversion to a sawgrass dominated habitat. The sparrow's ability to feed, breed and shelter would be reduced but not eliminated and the changes are not expected to render the habitat unsuitable or unusable by sparrows. Therefore, we do not anticipate a reduction in the population of sparrows in this subpopulation.

Because there will be no direct mortality or injury of sparrows, subpopulations B and C will remain relatively unchanged, and the anticipated degradation of sparrow habitat in subpopulation D is not considered to be so extensive as to render habitat unsuitable or unusable by sparrows, the numbers, distribution and reproduction of sparrows are not anticipated to be appreciably affected by the proposed action.

Cape Sable Seaside Sparrow Critical Habitat

Project impacts to designated critical habitat for the Cape Sable seaside sparrow were based on potential effects to the PCEs. The Service does not anticipate any appreciable impacts to any of the PCEs for sparrow critical habitat unit 1 (subpopulation B). This critical habitat unit will continue to provide the functions for which it was designated for the conservation of the species.

The Service does not anticipate any appreciable impacts to PCEs 1, 3, and 4 in sparrow critical habitat unit 2 (subpopulation C). As described above for the corresponding subpopulation, this critical habitat unit would experience changes in hydroperiods which may affect PCE 2 (herbaceous vegetation). Critical habitat unit 2 would experience increased hydroperiods beyond the optimal condition (60 to 180 days) on 1,320 acres during a wet year, but would experience improved hydroperiods on 1,442 acres during an average year and would experience no change in hydroperiods in a dry year. When average and dry years are combined they are expected to occur more frequently than wet years. Therefore, the increased hydroperiods in a wet year are not anticipated to be sustained over a long enough period of time to result in loss of suitable habitat described as PCE 2. As a result, the functions for which critical habitat unit 2 was designated for the conservation of the species would not be appreciably altered.

Critical habitat unit 3 (subpopulation D) would experience extended hydroperiods across 1,606 acres in an average year and 1,421 acres in a wet year. These changes in hydroperiods will affect PCE 2, herbaceous vegetation. No other PCEs are anticipated to be appreciably affected by the proposed action. The overlap in extended hydroperiods in wet and average years indicates likely sustained increased hydroperiods that would affect PCE 2 which is defined as "Herbaceous vegetation includes greater than 15 percent combined cover of live and standing dead vegetation of one or more of the following species: muhly grass, Florida little bluestem, blacktopped sedge, and cordgrass." We used the 60 to 180-day discontinuous hydroperiod metric to measure optimal conditions for maintenance of this PCE, although these grass species can be found in hydroperiods greater than 180 days, but in less than optimal conditions (Ross et al. 2006). Table 8 illustrates that essentially all of critical habitat unit 3 (subpopulation D) will experience increased hydroperiods and that approximately 1,606 acres (16 percent of the critical habitat unit) would extend beyond the optimal conditions of 180 days where they currently do not. However, none of the acreage currently below a 180-day hydroperiod would extend beyond a 192-day hydroperiod with the proposed action, with the greatest change (875 acres) going from 152 days under current conditions to 183 days with the proposed action. These increased hydroperiods are anticipated to degrade PCE 2 by potentially altering the vegetative density or diversity of preferred grasses used by sparrows, but the changes are not expected to be so severe as to eliminate the preferred grass species (PCE 2) across this acreage in critical habitat unit 3. Therefore, the functions for which critical habitat unit 3 was designated for the conservation of the species would not be appreciably altered.

INCIDENTAL TAKE STATEMENT

Sections 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in action 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement.

AMOUNT OR EXTENT OF TAKE

Eastern Indigo Snake

Eastern indigo snakes are likely to occur in the project area in low densities. Although the Corps will implement measures to minimize the risk of harassing or harming indigo snakes from construction activities, indigo snakes may be hidden in pockets of vegetation, rock crevices and other places where they may not be evident and therefore susceptible to unintentional injury or mortality due to construction. We anticipate take in the form of harassment of up to six indigo snakes from construction disturbance, flooding and associated project operations, the destruction of no more than one nest, and no more than 1 indigo snake would be killed or injured as a result of construction activities. Incidental take in the form of harm from substantial habitat degradation is not anticipated for the eastern indigo snake.

Cape Sable Seaside Sparrow

Incidental take in the form of harassment of sparrows due to disturbance from construction equipment and human activity in the project area is not anticipated. Incidental take in the form of direct injury or mortality (harm) of sparrows from construction-related activities or operations is not anticipated. Incidental take in the form of harm from substantial habitat degradation across 1,606 acres in subpopulation D is anticipated. Habitat degradation through extended hydroperiods is anticipated to result in changes in how sparrows use that habitat for breeding, feeding and sheltering.

The U.S. Court of Appeals, Eleventh Circuit ruling in Miccosukee Tribe of Indians of Florida v. Service, finds that the Act "requires that the incidental take statement must contain an adequate trigger for re-consultation, and that a trigger must be expressed in population terms unless it is impractical to do so."

The Service concludes it would be impractical to assign a number of sparrows that would be incidentally taken as a result of habitat degradation for the following reasons:

1. There is a low and variable density of sparrows in subpopulation D. Subpopulation D had an estimated 400 sparrows in 1981. Since then the population estimates have been reduced, with no sightings of sparrows from 2002 to 2004, and with only a few sparrows detected in 2006 through 2009.
2. Current survey protocols are designed to estimate populations, but do not provide an actual population count. Therefore, these methodologies are useful for providing trends over time, but would not be reliable in providing whether operations in one year caused a specific reduction in sparrow nest success or population, if it could be determined that the operations were the cause of such an impact.
3. The effects of habitat degradation are not anticipated to result in a decline in the sparrow population, but may result in changes in the use of that habitat by sparrows.

4. Given that sparrows (a) have a short lifespan (2-3 years); (b) can nest several times in a year; (c) nest success rates vary among years (12 to 53 percent) (Lockwood et al. 2001); and (d) nest failures are largely attributed to predation; and e) territories are relatively small, contain unsuitable habitat, appear transitional between years, and do not completely overlap all suitable habitat in a subpopulation, the ability to assign potential nest failure or lack of subsequent nesting due to degradation of habitat across a relatively small area (16 percent) of the subpopulation would be impractical.

Therefore, the Service issues incidental take in the form of harm through habitat degradation across 1,606 acres due to increased hydroperiods in subpopulation D. This incidental take would be exceeded if: (1) hydroperiods exceeding 180 days occurred over more than 1,606 acres as a result of the proposed action as compared to the baseline, and (2) currently suitable habitat within subpopulation D in 1,606 acres receiving hydroperiods greater than 180 days experiences undesirable shifts in suitable habitat conditions for the sparrow; that is, there should be no appreciable change in the percent of aerial coverage of live and standing dead vegetation of grass species preferred by sparrows as a result of the project, including *Muhlenbergia spp.*, *Schoenus spp.*, and *Schizachyrium spp.*, as measured within established plots along permanent transect(s) representative of habitat conditions in those 1,606 acres as detailed in Term and Condition 6 of this Biological Opinion. Appreciable change will be defined as any statistically significant negative change in percent of aerial coverage of live and standing dead vegetation of all grass species preferred by sparrows as a result of the project. This will be measured by readings recorded and analyzed over all established plots along the permanent transect(s) and comparing the baseline condition established at the transect(s) prior to commencement of project operations, to subsequent measurements at the same transect(s) taken at 2 year intervals after project operations commence and with consideration of any changes in natural conditions outside of the control of the project operations.

REASONABLE AND PRUDENT MEASURES

Eastern Indigo Snake

The Applicant has committed to implement the *Standard Protection Measures for the Eastern Indigo Snake* (Service 2004a) to reduce the risk of construction impacts on the indigo snake. The Service believes that these measures are sufficient and that no additional reasonable and prudent measures are necessary to minimize the effects of incidental take of the eastern indigo snake.

Cape Sable Seaside Sparrow

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of Cape Sable seaside sparrows.

1. Minimize the impacts of operations that affect sparrow suitable habitat.

2. In order to assure the effects of the C-111 SC Project operations do not exceed the level of impacts anticipated in this Biological Opinion, obtain information on:

a. The status and distribution of sparrows in areas affected by the C-111 SC Project operations;
b. Impacts of hydrology on the sparrow;
c. The effects of operational changes at specific structures on hydrology in the habitats occupied by the sparrow including the validity of the use of the trigger cell location in subpopulation D and effects of its application to regulate operations to protect sparrows; and
d. The effects of operational changes at specific structures on hydrology in the habitats occupied by the sparrow including the validity of the use of the trigger cell location in subpopulation C and effects of its application to regulate operations to protect sparrows.

3. Develop a conceptual habitat improvement plan and implement habitat improvements for at least 1,606 acres in or around Cape Sable seaside sparrow subpopulation D.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps and/or D, and hereafter throughout the document referred to as the "applicant" must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. The applicant will provide annual reports for a period of 10 years following initiation of operations, evaluating the relationship of project operations to the following habitat and nesting criteria to determine whether project effects have exceeded those analyzed in this Biological Opinion.

   a. Annual discontinuous hydroperiod at monitored existing and new wellpoints as defined in Term and Condition 2 below, at other locations as deemed appropriate, and estimated acreage affected by hydroperiod greater than 180 days in sparrow subpopulations C and D.
   b. Maximum continuous dry period in days during the period from March 1 to July 15 at the above locations, and estimated acreage which remains dry for 40 to 60 continuous days, 60 to 80 continuous days, and greater than 80 continuous days in sparrow subpopulations C and D.
   c. Analysis at the above locations of the frequency and duration that depth exceeds 20 centimeters during the period from March 15 to June 30, and the total acreage exceeding 30 continuous days in subpopulations C and D. Following the 10 year reporting period the applicant and Service will reevaluate the need to continue this reporting requirement.

2. The applicant will continue to evaluate and adjust criteria if needed for project operations in relationship to trigger cell locations in subpopulations C and D, in partnership with the Service and other agencies, in anticipation of full implementation of the C-111 SC Phase 1 Project. This will include:

a. Documentation of daily operation stage at existing project structures (S-18C, S-197, S-198 when constructed, S-176, S-177, S-178, S-332D and S-174) and resultant stage at the trigger cell locations in both subpopulation C and D. Data will be made available on a website that consolidates this information.
b. Documentation of daily stage at the trigger cell locations in both subpopulations with daily stage at existing wells (EVER4, EVER7, NTS1, NTS10, R3110, E112) and additional wellpoints installed in subpopulation D (Figure 22 provides the location of existing wellpoints and recommended new locations in subpopulation D). Data will be made available on a website that consolidates this information.
c. Establishment of the relationship of 2a and 2b above with above ground depth and duration (discontinuous hydroperiod) in sparrow subpopulations C and D.
d. The above evaluations should be based on a minimum of 5 years of existing data collected at existing structures and at least 1 year of data collected at the proposed new wells prior to project operations to establish baseline conditions, and continue throughout the implementation of phase 1 which will facilitate recommendations for implementation of Phase 2 if proposed and authorized.
e. The applicant will provide annual reports to the Service for a period of 10 years documenting the above requirements as well as conducting meetings as needed to facilitate and discuss implementation, development, and review of the above data.

3. The applicant will conduct additional surveys necessary to more accurately document existing topography in subpopulations C and D. The applicant will provide a methodology to accomplish this Term and Condition for approval by the Service within 6 months of receipt of this Biological Opinion. The surveys should be accomplished prior to initiation of the operation of project features. The purpose of these surveys is to correlate stage data collected at the monitoring wells with acres of inundation caused by project operations within subpopulations C and D.

4. The applicant commits to working in cooperation with the Service, FWC, ENP, and other applicable land management agencies to develop a conceptual habitat improvement plan and implement habitat improvements for approximately 1,600 acres in or around Cape Sable seaside sparrow subpopulation D and other areas as appropriate. The conceptual sparrow management plan will be submitted for review and approval by the Service within one year of the date of this Biological Opinion. The agreed upon final management plan will include estimated costs and time frames for completion of agreed upon actions. This plan will focus on identification of potential sparrow habitat improvements on public lands or with willing private property owners. The management plan should include consideration of measures such as: 1. woody vegetation removal and control; 2. a prescribed and natural/human caused fire management plan; 3. manipulation of soil elevation and possibly plantings/seeding to encourage plant species preferred by sparrows; 4. creation of pockets of deeper sawgrass refugia for shelter and prey production; and 5. a monitoring plan for all areas included. The management plan should also consider the potential relationship that future projects such as the C-111 SC Project (Eastern) Phase 2 and other CERP projects could have on areas that will be enhanced under the sparrow management plan.

5. The applicant will conduct interagency operational conference calls to coordinate and discuss operating criteria that could minimize impacts to the sparrow. These discussions will occur prior to changes in operating criteria and thereafter monthly or as needed for the duration of the project operation. The goal of these meetings would be to adaptively manage operations to achieve the overall project objectives while minimizing effects to listed species and adhering to other legal mandates.

6. The applicant must ensure that monitoring is sufficient to track the nature, amount, and extent of take in subpopulation D resulting from implementation of the C-111 SC Phase 1 project. This monitoring will document baseline conditions, be implemented upon initiation of operations, and continued throughout phase 1 operations or until reconsultation is required by implementation of future projects. Monitoring should utilize existing ongoing studies and comparable methodologies when appropriate unless otherwise stated in the terms and conditions. This includes, at a minimum:

   a. Vegetation – (a.) Documentation of the baseline status of sparrow subpopulation D habitat; and (b.) After implementation of project operations, biannual (every 2 years) documentation of the status of sparrow subpopulation D habitat and any vegetative shifts that may occur within those habitats (Figure 22 provides the location of existing vegetation transect studies and recommended new locations).
   b. Sparrow Status – Annual determination of the number and locations of sparrows, nesting efforts, and the success rate of those nesting efforts in subpopulation D.

Upon locating a dead, injured, or sick specimen of any threatened or endangered species, initial notification must be made no later than 24 hours of discovery to the nearest Service Law Enforcement Office (Fish and Wildlife Service; 9549 Koger Boulevard, Suite 111; Street Petersburg, Florida 33702; 727-570-5398). Secondary notification should be made to the Florida Fish and Wildlife Conservation Commission; South Region, 3900 Drane Field Road, Lakeland, Florida, 33811-1299; 1-800-282-8002. Care should be taken in handling sick or injured specimens to ensure effective treatment and care or in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured specimens or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to further minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends:

1. The applicant investigate the potential for the exposure of federally listed species to contaminants when former agricultural and industrial lands, including the former Aerojet test facility, are flooded such as will occur in construction and operation of the Frog Pond

Infiltration Basin, and stage changes due to project components such as the Aeroject Canal (pump station, weirs, and perimeter berming), Intermediate Water Control Features (S-198), Incremental S-18C Changes, L-31E Canal changes (plug at S-20A, and operational changes at S-20), C-110 Canal Changes (earthen plugs), and the Design Test. If the ecological risk from contaminants to listed species becomes evident, the Corps should contact the Service to determine if re-initiation of consultation in accordance with section 7 of the Act is necessary.

2. After final construction plans have been completed, the applicant should implement precautions to avoid potential collisions with panthers including limiting construction activities to daylight hours when any panthers present would be less active.

3. Should blasting be necessary as part of construction, the applicant should follow the Service's "Guidelines for the Protection of Marine Animals During the Use of Explosives In the Waters of the State of Florida" (Service 2006c).

4. The applicant conduct surveys prior to and during construction according to Snail Kite Survey Protocol (Enclosure 2), in addition to accessing all additional data from resource managers and researchers on presently documented locations of foraging areas, snail kite nest sites, and kite protection buffers. Draft Snail Kite Management Guidelines | (Enclosure 3) for protection buffers and management areas should be followed.

5. The applicant monitor noise levels during construction and implement precautions and restrictions if disturbance is indicated to any monitored nesting and foraging sites for Everglade snail kites or wood storks. Studies have documented various disturbance effects such as nest relocation, interrupted brooding, and flushing on avian wildlife at noise ranges above 40 decibels (Cowan 1993; U.S. Department of Energy 2001, Imperial Oil Resources Ventures Limited 2005; Knauer 2006).

6. Due to the possibility of crocodiles nesting or being present in the project study area, and specifically in designated critical habitat, and because vehicular traffic will temporarily increase during project construction, which may affect crocodiles if they are present, the applicant should conduct pre-construction crocodile surveys for this project. At this time, the Service has no formal written guidelines to reduce construction-relate effects on crocodiles. However, if crocodile activity or nesting is observed, the Service will work with the applicant to outline reasonable measures to avoid disturbing or injuring crocodiles.

7. Due to the uncertainties associated with the occurrence of eastern indigo snakes in the project study area, the applicant should conduct preliminary surveys for likely prime habitat areas that may be occupied by indigo snakes (such as rock crevices, spoil mounds, root wads, and hardwood hammock areas) that will be impacted directly in the project footprint construction activities. This could facilitate possible avoidance of construction related mortalities.

8. Due to the uncertainty in the construction schedule (*i.e.*, sequencing, duration and timing of construction activities), variability in inter- and intra-annual rainfall, and inter-annual variability in sparrow nest location, construction activities associated with canal plugging and levee enhancement be conducted outside of the sparrow breeding season or when water levels in the canal are well below the regional ground surface elevation.

9. Due to the anticipated changes indicated by model output for the project, vegetation surveys should be expanded to areas outside the critical habitat that model output indicates will be affected by hydroperiod changes potentially beneficial to sparrows, in addition to monitoring areas that may currently be utilized by sparrows. These surveys should include transects that include observations of vegetation, periphyton, soils, and topography.

10. Ground tracking and banding surveys that have been conducted for sparrows in the project study area (Lockwood et al. 2006) should be continued for critical habitat within the project study area and possibly expanded to areas that model output indicates could exhibit hydrologic conditions conducive to the sparrow.

11. The applicant develop and implement a monitoring and adaptive management plan for the interim operation of this system until all restoration projects in the area can be brought on line and the uncertainty regarding such actions reduced.

12. The applicant should conduct interagency operational conference calls to coordinate and discuss operations that could minimize impacts to listed species not covered by the terms and conditions in this Biological Opinion. These calls should occur as needed during all stages of project construction and operations. The goal of these meetings would be to adaptively manage operations to achieve the overall project objectives while minimizing effects to listed species and adhering to other legal mandates.

13. As public or private properties with limited information regarding the presence of federally listed species are accessed or acquired (or easements are negotiated), the applicant should conduct more detailed surveys to determine the presence of listed species. If listed species are found, the applicant should contact the Service to determine if re-initiation of consultation in accordance with section 7 of the Endangered Species Act is necessary.

14. The applicant notify the Service's South Florida Ecological Services Office no later than one month prior to start of the construction phase for any of the components so that we may, if available, observe construction activities and monitor effects, if any, of construction activities on threatened and endangered species.

15. Contractor personnel will be informed of the potential presence of threatened and endangered species in the project area and will be updated on precautionary measures and the Act prohibition on taking listed species. Due to the probability that threatened and endangered species may be present in construction sites, contractors will be trained on how to identify each species.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the Biological Assessment. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the applicant's action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the applicant's action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

Thank you for your cooperation and effort in protecting fish and wildlife resources. If you have any questions regarding this project, please contact me at 722-562-3909.

Sincerely yours,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc: w/enclosures (electronic copy only)
SOL/DOI, Atlanta, Georgia (Michael Stevens)
Biscayne National Park, Homestead, Florida (Sarah Bellmund)
Corps, Jacksonville, Florida (Rebecca Griffith, Michael Collis, Raymond Wimbrough, Brad Tarr)
Corps, West Palm Beach, Florida (Tori White)
District, West Palm Beach, Florida (John Shaffer, Dewey Worth)
ENP, Homestead, Florida (Alicia LoGalbo, Dan Kimbell, William Perry)
DEP, West Palm Beach, Florida (Inger Hansen, Annett Forkink)
FWC, Vero Beach, Florida (Joseph Walsh, MaryAnn Poole)
Miami-Dade County DERM, Miami, Florida (Susan Markley)
NOAA Fisheries, Miami, Florida (Audra Livergood)
Service, Atlanta, Georgia (David Horning)
Service, Jacksonville, Florida (Miles Meyer)
Service, Jackson, Mississippi (Linda LaClaire)
Service, Vero Beach, Florida (Marilyn Knight)

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Table 1. List of acronyms and abbreviations used.

Act	Endangered Species Act of 1973, as amended
BCIY	Big Cypress National Preserve
C&SF	Central and Southern Florida
CERP	Comprehensive Everglades Restoration Plan
Corps	U.S. Army Corps of Engineers
District	South Florida Water Management District
EDR	Engineering Documentation Report
EIS	Environmental Impact Statement
ENP	Everglades National Park
FWC	Florida Fish and Wildlife Conservation Commission
IOP	Interim Operational Plan
ISOP	Interim Structural and Operational Plan
RPA	Reasonable and Prudent Alternative
SDCS	South Dade Conveyance System
Service	U.S. Fish and Wildlife Service
STA	Stormwater Treatment Area
WCA	Water Conservation Area

Table 2. Difference in wading bird performance criteria calculated habitat units by month and modeled year, comparing without-project (IOR) and with-project (IORw/Proj) conditions. Habitat units are calculated for the optimal 23 percent of available foraging habitat preferentially selected by foraging species (Gawlik et al. 2004). Data is summarized for the project study area and for the Taylor Slough indicator region.

Total Study Area Net Ave. Monthly Change

	Monthly Average Wading Bird Habitat Units					
Total Acres = 155098 23% of Area = 35671	November	December	January	February	March	April
IOR - IORw/Proj_78 (avg)	-878	-419	94	353	42	-43
IOR - IORw/Proj_89 (dry)	-6	-339	-5	20	1	-13
IOR - IORw/Proj_95 (wet)	45	-7122	1659	346	799	-180

Taylor Slough Net Ave. Monthly Change

	Monthly Average Wading Bird Habitat Units					
Total Acres = 26105 23% of Area = 6004	November	December	January	February	March	April
IOR - IORw/Proj_78 (avg)	0	0	14	-12	11	28
IOR - IORw/Proj_89 (dry)	21	-16	-28	8	0	0
IOR - IORw/Proj_95 (wet)	0	-3761	49	254	54	-79

Key	% Change of 23% Optimal Habitat	> 50	10 to 50	>0 to <10	0	< 0 to > -10	-10 to > -50	< -50

Table 3. Estimated numbers of Cape Sable seaside sparrows within subpopulations A through F from 1981 to 2009. Two surveys were conducted in 1999 and 2000.

Population	A		B		C		D		E		F		Total	
Year	**BC**	**Est**	**BC**	**Est**	**BC**	**Est**	**BC**	**Est**	**BC**	**Est**	**BC**	**Est**	**BC**	**Est**
1981	168	2,688	147	2,352	27	432	25	400	42	672	7	112	416	6,656
1992	163	2,608	199	3,184	3	48	7	112	37	592	2	32	411	6,576
1993	27	432	154	2,464	0	0	6	96	20	320	0	0	207	3,312
1994	5	80	139	2,224	NS	NS	NS	NS	7	112	NS	NS	151	2,416
1995	15	240	133	2,128	0	0	0	0	22	352	0	0	170	2,720
1996	24	384	118	1,888	3	48	5	80	13	208	1	16	164	2,624
1997	17	272	177	2,832	3	48	3	48	52	832	1	16	253	4,048
1998	12	192	113	1,808	5	80	3	48	57	912	1	16	191	3,056
1999a	25	400	128	2,048	9	144	11	176	48	768	1	16	222	3,552
1999b	12	192	171	2,736	4	64	NS	NS	60	960	0	0	247	3,952
2000a	28	448	114	1,824	7	112	4	64	65	1,040	0	0	218	3,488
2000b	25	400	153	2,448	4	64	1	16	44	704	7	112	234	3,744
2001	8	128	133	2,128	6	96	2	32	53	848	2	32	204	3,264
2002	6	96	119	1,904	7	112	0	0	36	576	1	16	169	2,704
2003	8	128	148	2,368	6	96	0	0	37	592	2	32	201	3,216
2004	1	16	174	2,784	8	128	0	0	40	640	1	16	224	3,584
2005	5	80	142	2,272	5	80	3	48	36	576	2	32	193	3,088
2006	7	112	130	2,080	10	160	0	0	44	704	2	32	193	3,088
2007	4	64	157	2,512	3	48	0	0	35	560	0	0	199	3,184
2008	7	112	NS	NS	3	48	1	16	23	368	0	0	34	544
2009	6	96	NS	NS	3	48	2	32	27	432	0	0	38	608

NS = Not Surveyed

Table 4. Critical Habitat Units for the Cape Sable seaside sparrow within the C-111 SC Project study area. [Area estimates reflect all land within critical habitat unit boundaries based on Modbranch model calculations and areal delineations]

Critical habitat unit	Federal acres (within project study area)	State acres (within project study area)	Total acres (within project study area)
1. Unit 1 - Subpopulation B	39029	0	39,029
1. Unit 2 - Subpopulation C	8,304	0	8,304
1. Unit 3 - Subpopulation D	833	9,973	10,806

Table 5. Cape Sable Seaside Sparrow performance measures by representative year modeled (average, dry, wet), comparing without project to with project condition for subpopulation B.

Sparrow Subpop. B Critical Habitat (U1), Total number of acres = 39029

Performance Measures

	1978 (average)		1989 (dry)		1995 (wet)	
Simulation:	Without Project	With Project	Without Project	With Project	Without Project	With Project
Area with 60d<Hydroperiod<180d (acres)	25169	25169	2304	2304	313	313
Area Weighted Average Hydroperiod in areas with 60-180d HP (days)	136	136	92	92	155	155
Area with Max Continuous Dry Days > 80 days (acres)	21920	21920	38572	38572	8418	8418
Area Weighted Average of Maximum Continuous Dry Days in the areas with > 80 days (days)	117	117	137	137	92	92
Area Weighted Average of Maximum Continuous Dry Days in all areas (days)	85	85	137	137	52	52
Area with Maximum Wet Depth > 20 cm equal or greater than 1 day, 15 March - 30 June (acres)	0	0	0	0	12454	12557
Area with Maximum Wet Depth > 20 cm more than 30 days, 15 March - 30 June (acres)	0	0	0	0	1869.1	1869.1
Area Weighted Average of Number of Days Depth > 20 cm for more than 30 days, 15 March - 30 June (days)	0	0	0	0	95	95

Table 6. Cape Sable seaside sparrow performance measures by representative year modeled (average, dry, wet), comparing without project to with project condition for subpopulation C.

Sparrow Subpop. C Critical Habitat (U2), Total number of acres = 8304

Performance Measures

	1978 (average)		1989 (dry)		1995 (wet)	
Simulation:	Without Project	With Project	Without Project	With Project	Without Project	With Project
Area with 60d<Hydroperiod<180d (acres)	3240	4682	0	0	5771	4451
Area Weighted Average Hydroperiod in areas with 60-180d HP (days)	95	98	0	0	135	150
Area with Max Continuous Dry Days > 80 days (acres)	8304	8304	8304	8304	8305	8304
Area Weighted Average of Maximum Continuous Dry Days in the areas with > 80 days (days)	138	138	138	138	117	116
Area Weighted Average of Maximum Continuous Dry Days in all areas (days)	138	138	138	138	117	116
Area with Maximum Wet Depth > 20 cm equal or greater than 1 day, 15 March - 30 June (acres)	0	0	0	0	0	17
Area with Maximum Wet Depth > 20 cm more than 30 days, 15 March - 30 June (acres)	0	0	0	0	0	0
Area Weighted Average of Number of Days Depth > 20 cm for more than 30 days, 15 March - 30 June (days)	0	0	0	0	0	0

Table 7. Cape Sable seaside sparrow performance measures by representative year modeled (average, dry, wet), comparing without project to with project condition for subpopulation D.

Sparrow Subpop. D Critical Habitat (U3), Total number of acres = 10806

Performance Measures	1978 (average)		1989 (dry)		1995 (wet)	
Simulation:	Without Project	With Project	Without Project	With Project	Without Project	With Project
Area with 60d<Hydroperiod<180d (acres)	8763	7157	57	77	3675	2254
Area Weighted Average Hydroperiod in areas with 60-180d HP (days)	124	153	89	86	154	137
Area with Max Continuous Dry Days > 80 days (acres)	10302	10065	10806	10806	10284	9638
Area Weighted Average of Maximum Continuous Dry Days in the areas with > 80 days (days)	132	123	138	138	115	106
Area Weighted Average of Maximum Continuous Dry Days in all areas (days)	128	119	138	138	112	100
Area with Maximum Wet Depth > 20 cm equal or greater than 1 day, 15 March - 30 June (acres)	11	36	0	0	128	173
Area with Maximum Wet Depth > 20 cm more than 30 days, 15 March - 30 June (acres)	0	0	0	0	0	35.8
Area Weighted Average of Number of Days Depth > 20 cm for more than 30 days, 15 March - 30 June (days)	0	0	0	0	0	33

Table 8. Cape Sable seaside sparrow subpopulation D and its associated critical habitat (CH). Discontinuous hydroperiod (HP, total days per year) for initial operations, compared to initial operations with Alternative 2DShort for 1978 (an average year) and separated by incremental ground surface elevation in designated CH.

		CSSS Habitat Ave. Discontinuous HP/Year		
Ground Surface Elevation (ft.) NGVD29	**Total Acres/ Elevation**	**1978 (Ave.) Without Project (Days)**	**1978 (Ave.) With Project (Days)**	**1978 (Ave.) Change With Project (Days)**
1.6	11	202	210	8
1.7	14	174	190	16
1.8	29	146	167	21
1.9	374	192	209	17
2.0	532	162	182	20
2.1	717	165	192	27
2.2	570	162	182	20
2.3	875	152	183	31
2.4	1,066	153	182	29
2.5	1,321	135	176	41
2.6	1,299	120	176	56
2.7	931	101	171	70
2.8	1,265	81	165	84
2.9	1,011	64	142	78
3.0	529	64	124	60
3.1	182	61	115	54
3.2	65	57	114	57
3.3	15	41	110	69

Total Acres In CSSS-D CH 10,806
Total Acres w/60-180 HP Initial Operations ....10,341..........(96% of Total)
Total Acres w/60-180 HP Initial Operations w/Project...6,647............(62% of Total)

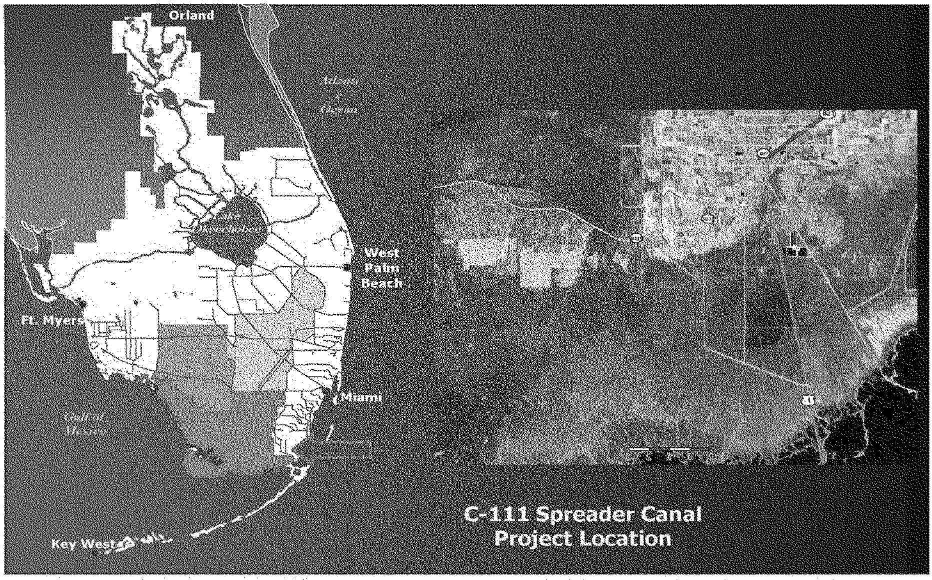

Figure 1. The C-111 SC Project Location.

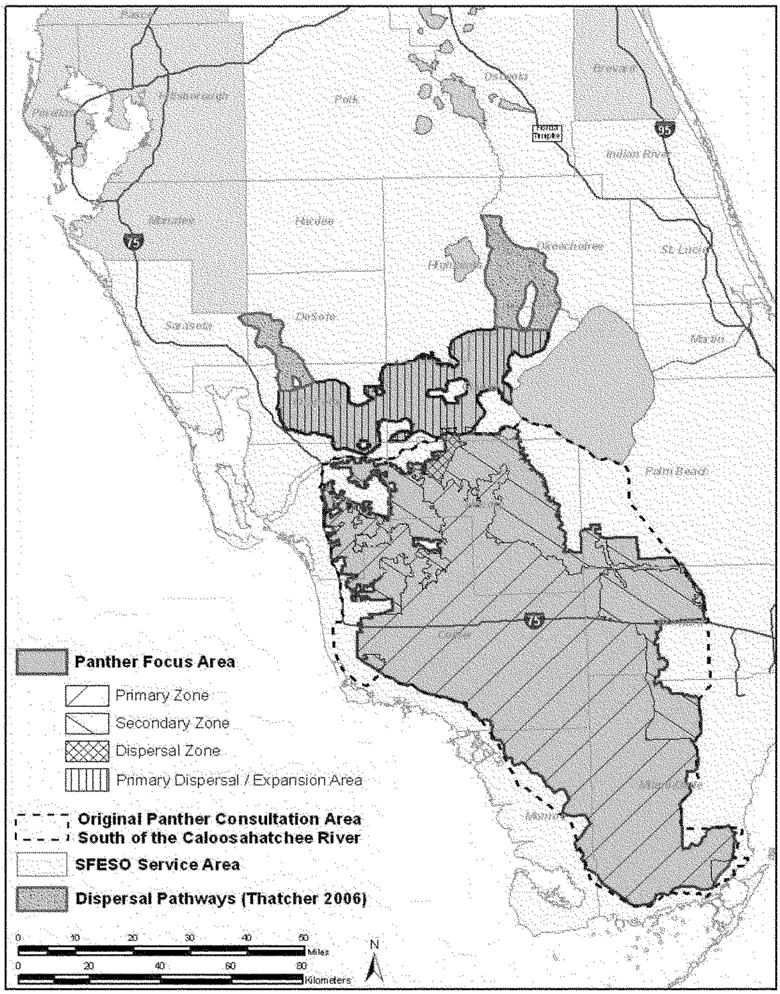

Figure 2. Florida Panther Focus Area including Primary Zone designation.

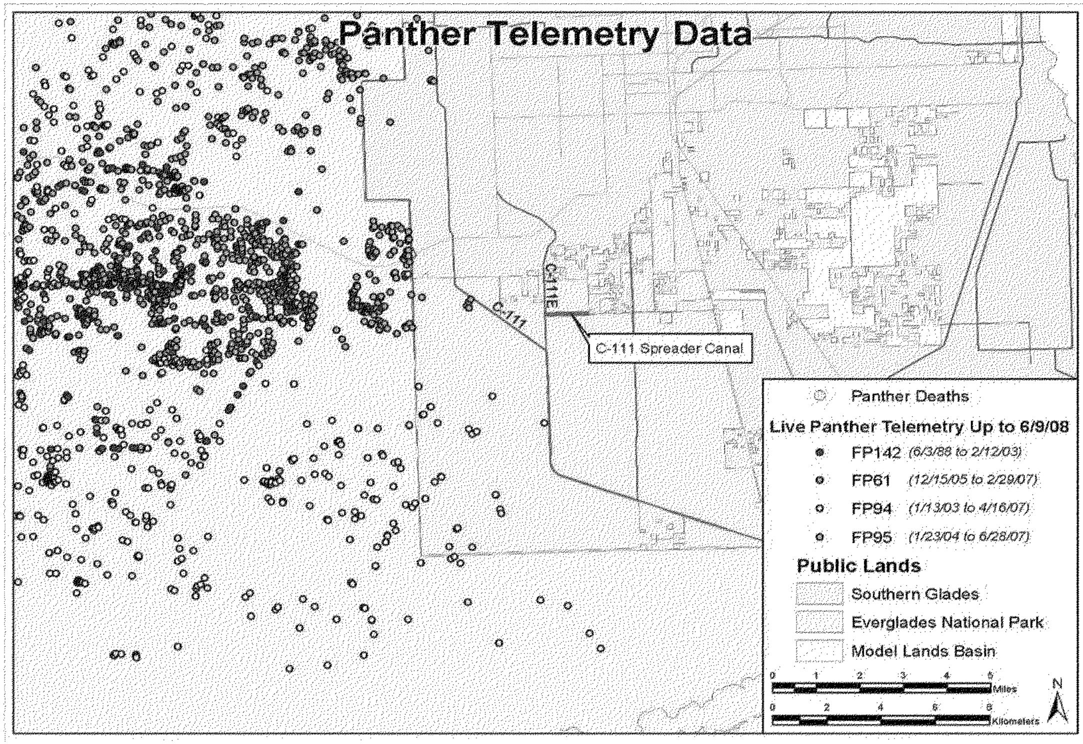

Figure 3. Florida panther telemetry locations in the C-111 Spreader Canal Project study area, based upon data collected through 6/9/2008 by personnel from the FWC, Big Cypress National Preserve, and ENP | (Service 2008b).

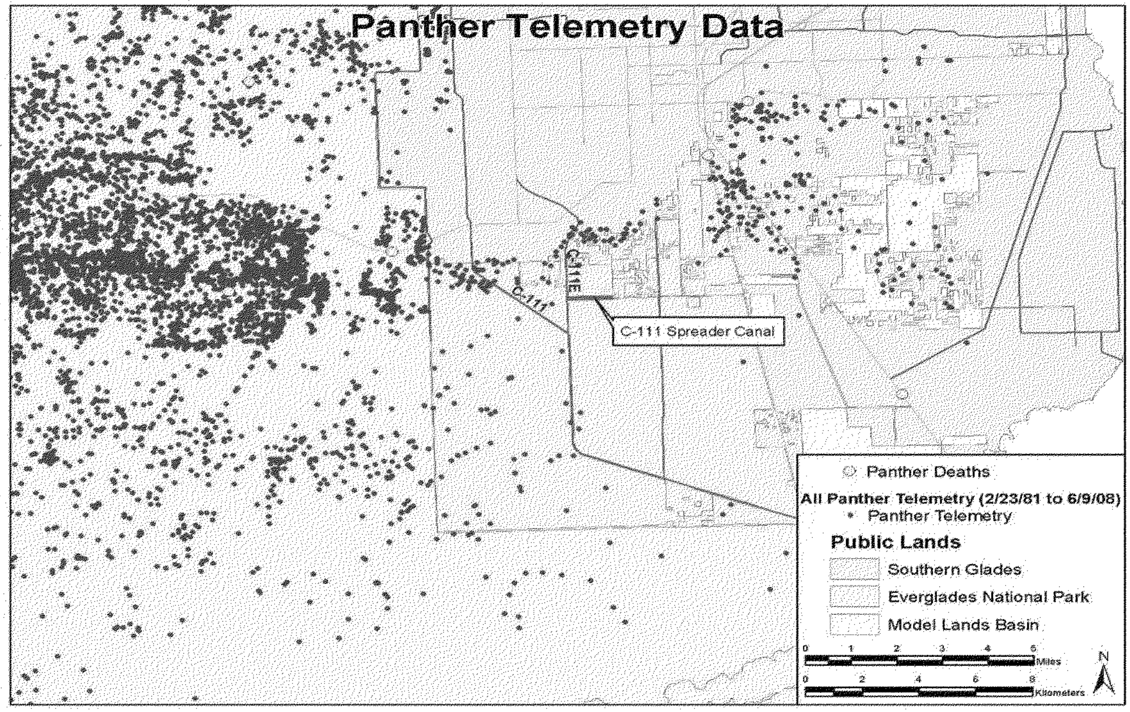

Figure 4. Florida panther telemetry locations in the C-111 Spreader Canal Project study area, based upon data collected from 3/81 through 6/9/2008 by personnel from the FWC, Big Cypress National Preserve, and ENP (Service 2008b).

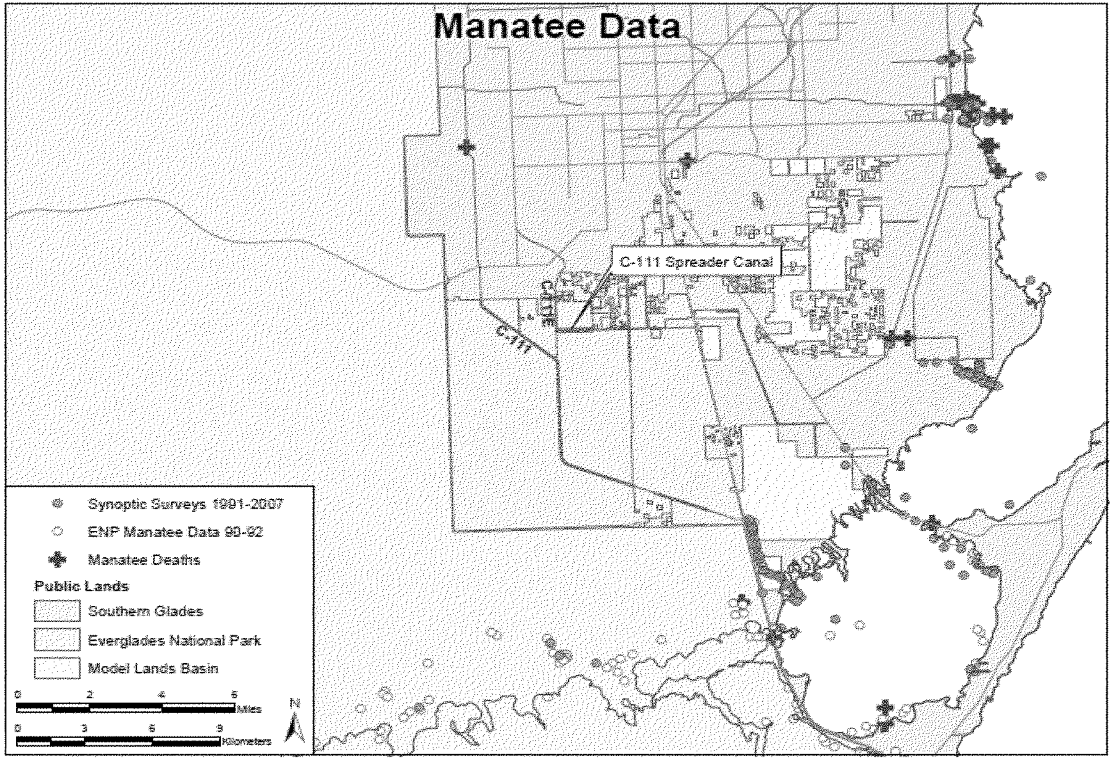

Figure 5. District canal infrastructure in the C-111 SC Project study area and documented locations of West Indian manatee observations and mortalities.

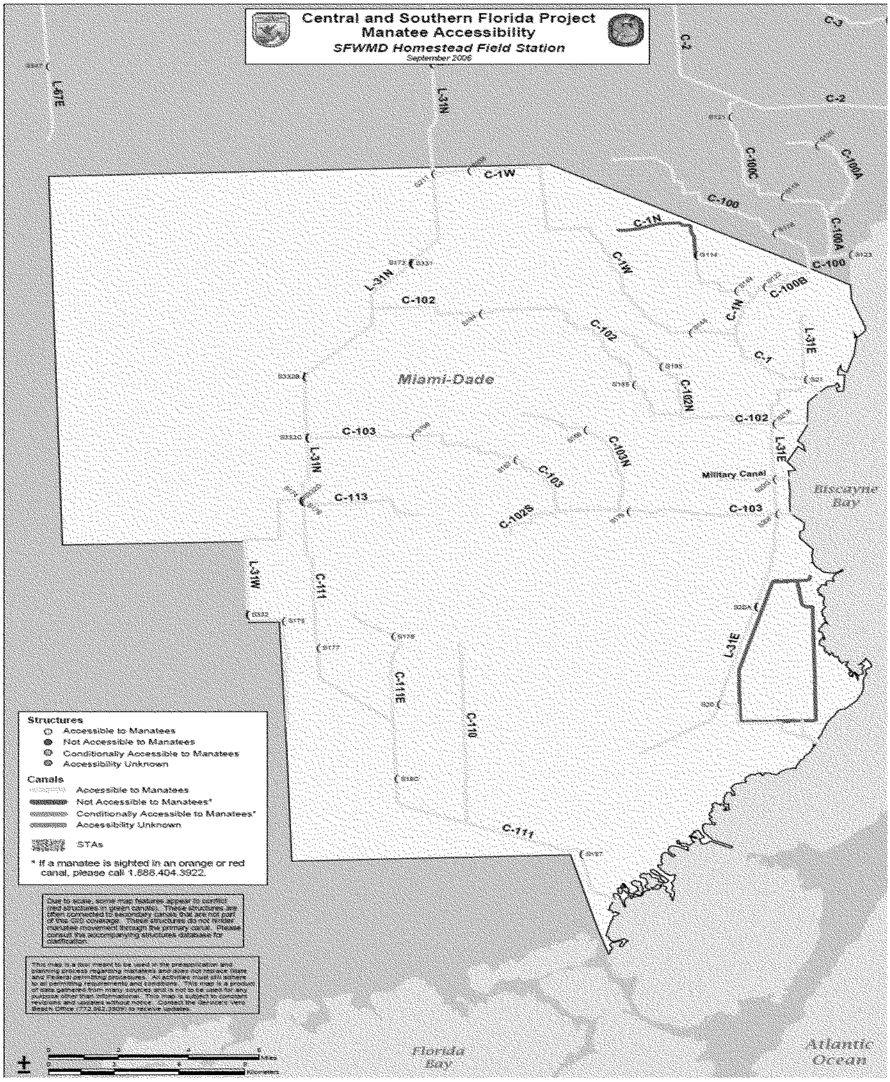

Figure 6. District canal infrastructure and West Indian manatee accessibility.

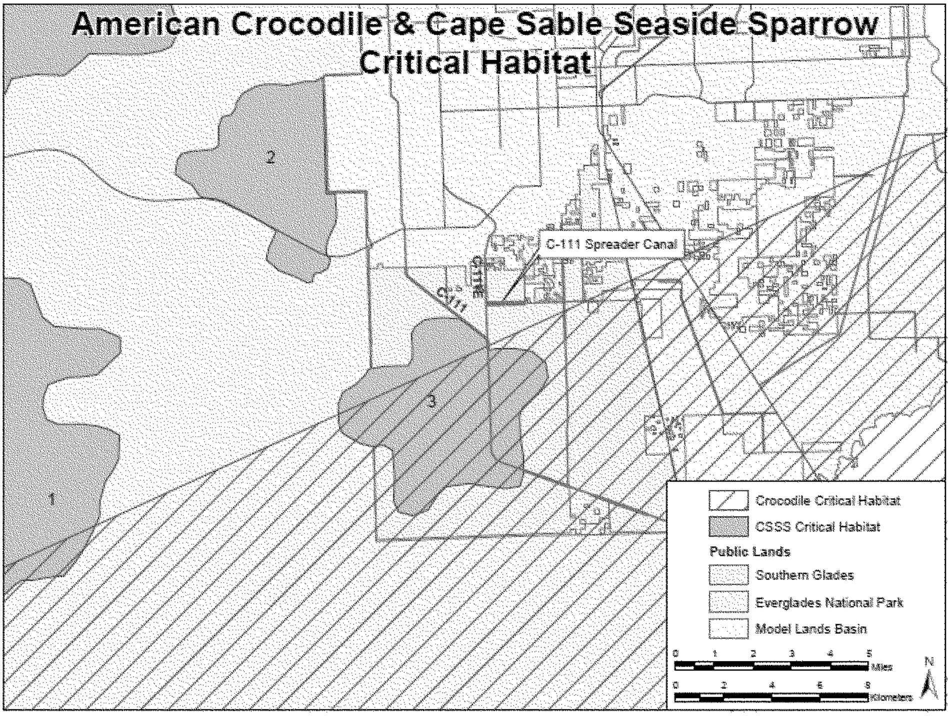

Figure 7. Location of critical habitat for the American crocodile and the Cape Sable seaside sparrow within the C-111 SC Project study area.

Figure 8. Locations of documented Eastern indigo snake observations (green diamonds) in the C-111 SC Project study area, based on the Florida Natural Areas Inventory GIS database covering the period 1951-1999 (Florida Natural Areas Inventory 2008).

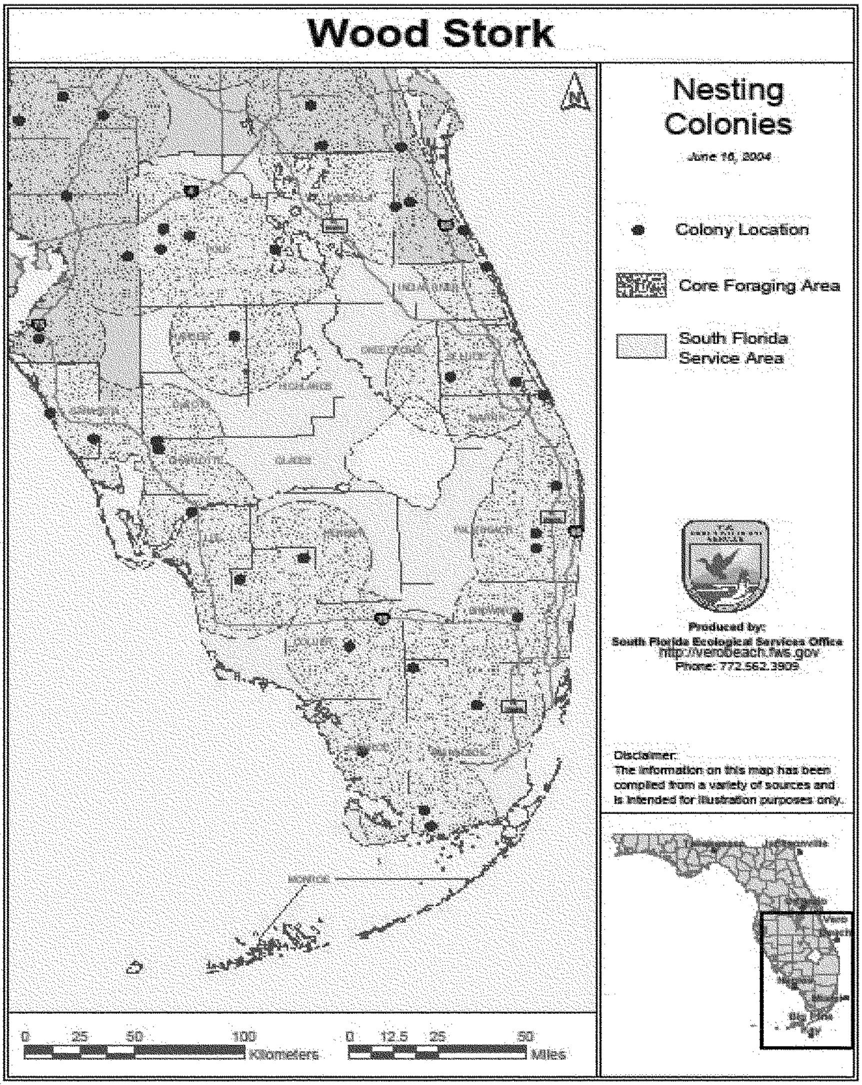

Figure 9. Wood stork nesting colony locations and core foraging areas documented in southern Florida.

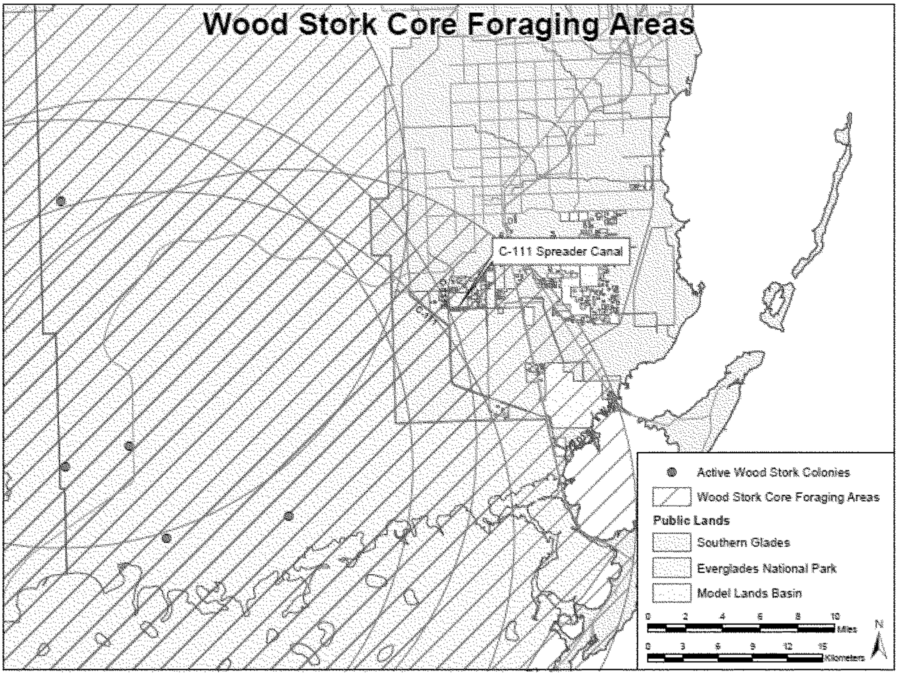

Figure 10. Wood stork core foraging Areas within the C-111 SC Project Study Area.

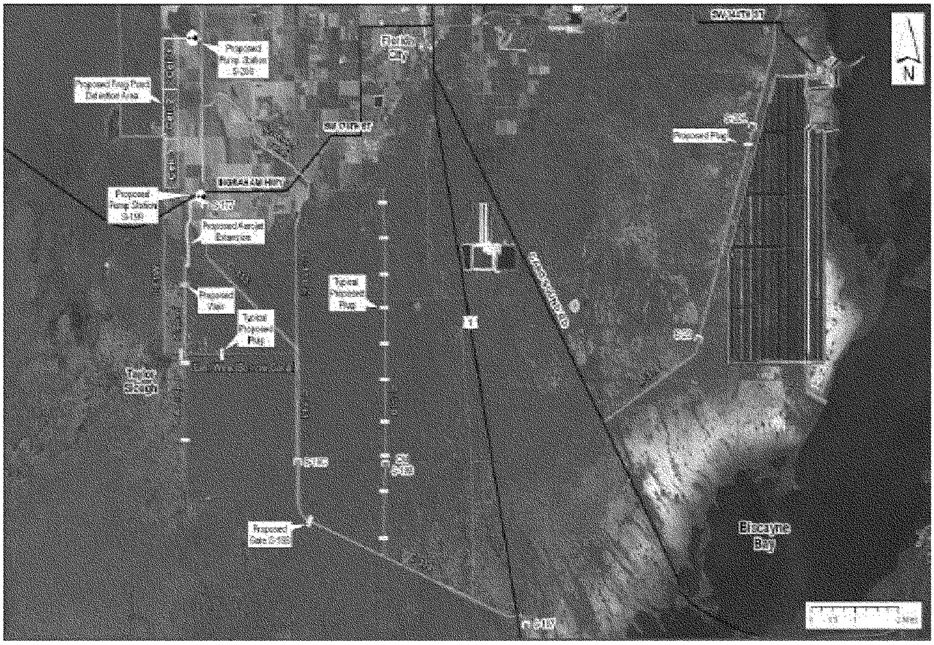

Figure 11. C-111 SC Project Phase 1 (Western PIR), project location and components of the recommended, alternative 2Dshort.

Figure 12. The C-111 SC Project Action Area (Red Outline).

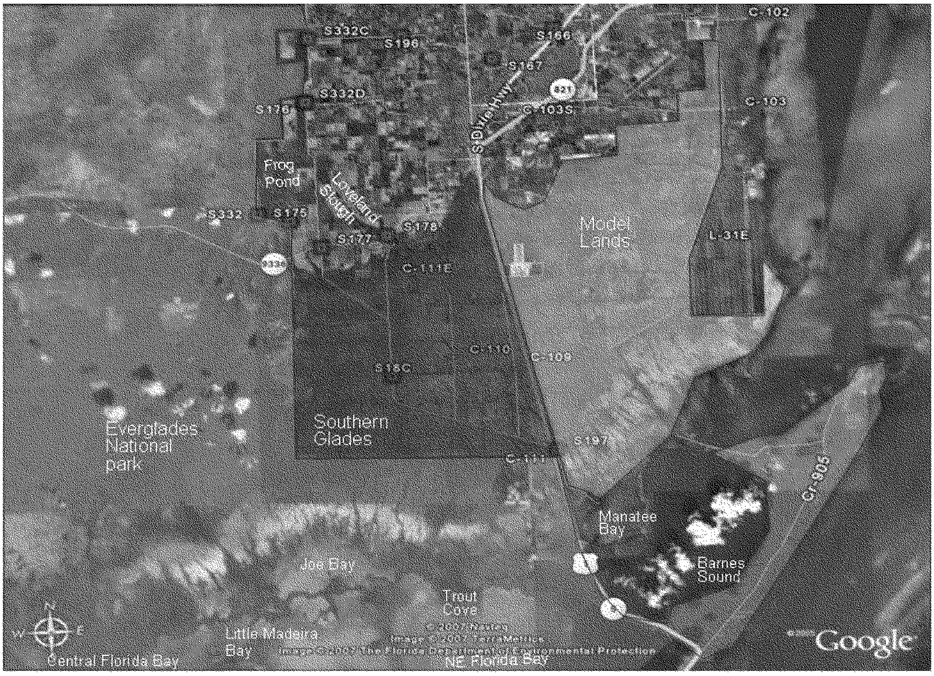

Figure 13. Location of the Southern Glades and the Model Lands in C-111 SC Project study area.

Figure 14. Location of Cape Sable seaside sparrow critical habitat areas B (Unit 1), C (Unit 2), D (Unit 3), E (Unit 4), and F (Unit 5) in relation to project study area features.

Figure 15. Location of Taylor Slough in C-111 SC Project study area.

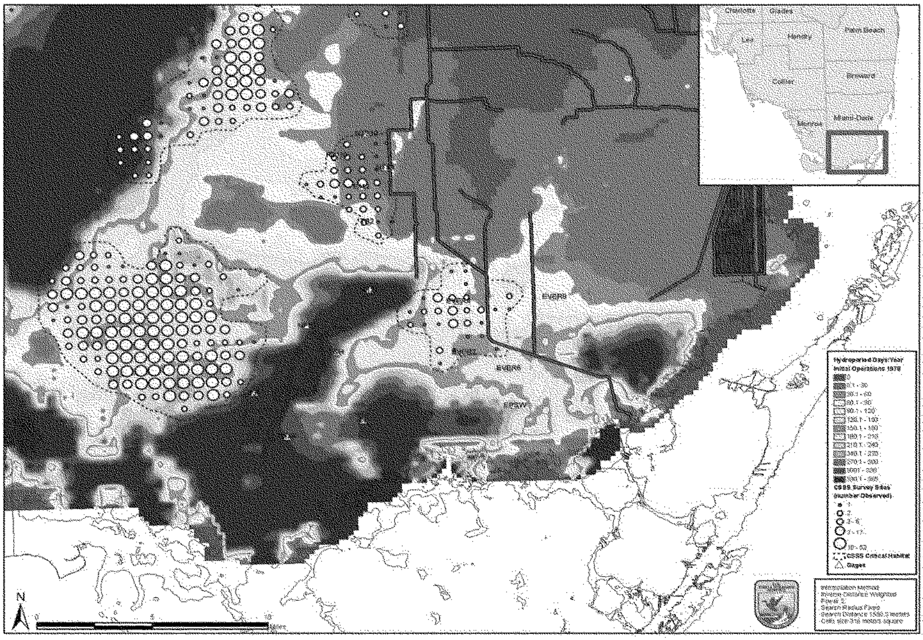

Figure 16. Location of Cape Sable seaside sparrow critical habitat, survey sites, numbers observed, and relationship to C-111 Spreader Canal Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the without-project condition for the modeled year 1978 (average).

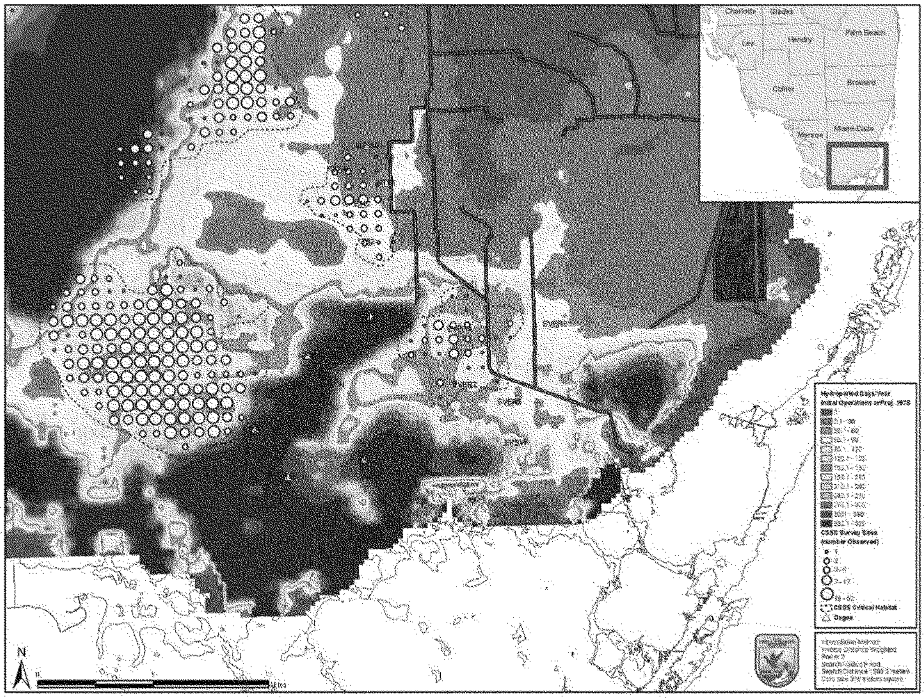

Figure 17. Location of Cape Sable seaside sparrow critical habitat, survey sites, numbers observed, and relationship to C-111 Spreader Canal Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the with-project condition for the modeled year 1978 (average).

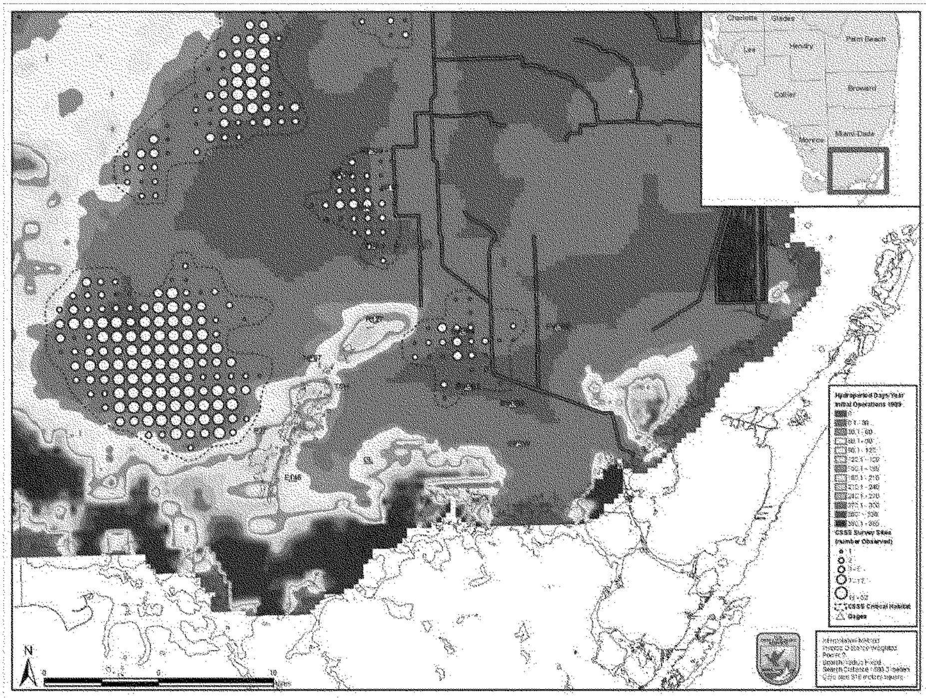

Figure 18. Location of Cape Sable seaside sparrow critical habitat, survey sites, numbers observed, and relationship to C-111 Spreader Canal Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the without-project condition for the modeled year 1995 (dry).

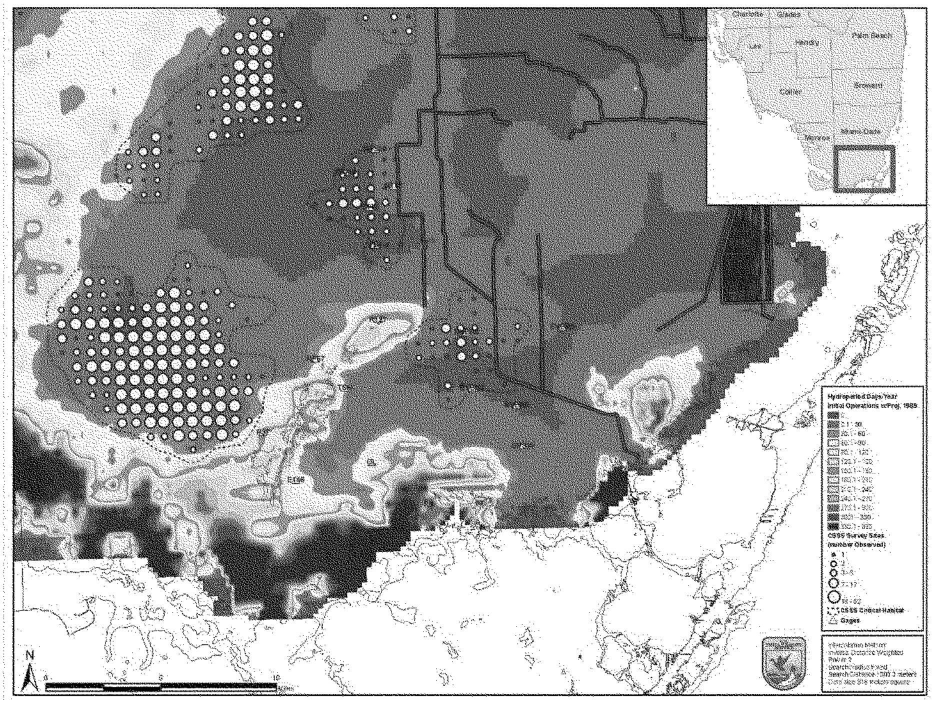

Figure 19. Location of Cape Sable seaside sparrow critical habitat, survey sites, numbers observed, and relationship to C-111 Spreader Canal Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the with-project condition for the modeled year 1989 (dry).

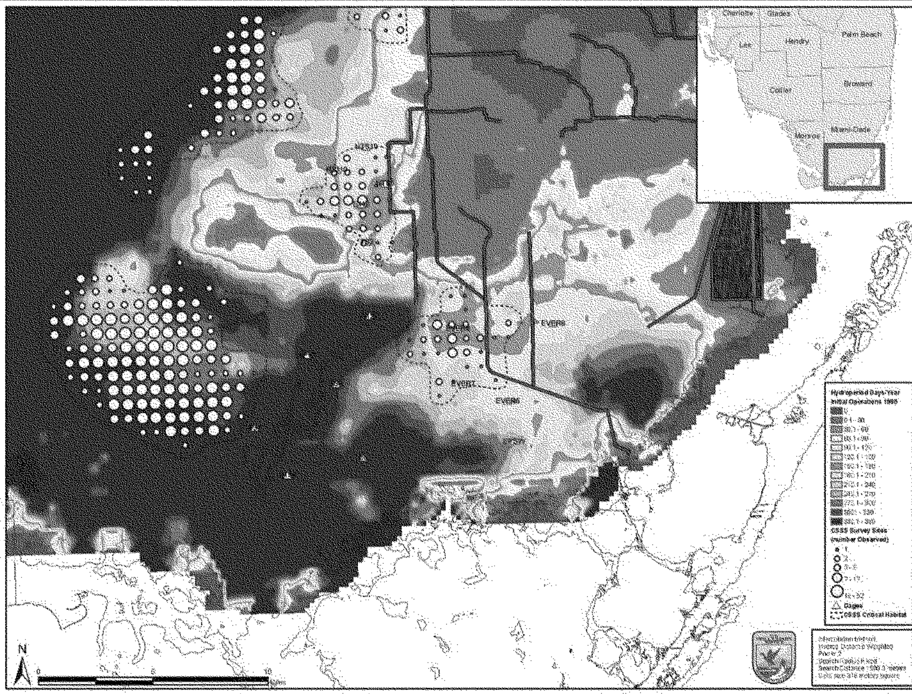

Figure 20. Location of Cape Sable seaside sparrow critical habitat, survey sites, numbers observed, and relationship to C-111 Spreader Canal Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the without-project condition for the modeled year 1995 (wet).

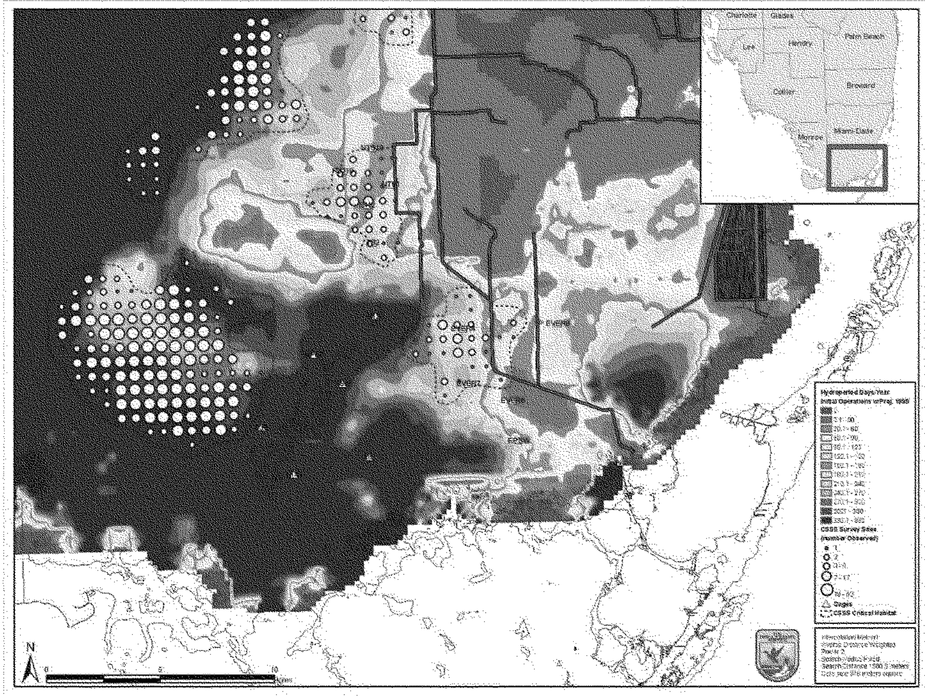

Figure 21. Location of Cape Sable seaside sparrow critical habitat, survey sites, numbers observed, and relationship to C-111 Spreader Canal Project (Phase 1). Shaded areas show discontinuous hydroperiod days (water levels above ground) per year for the with-project condition for the modeled year 1995 (wet).

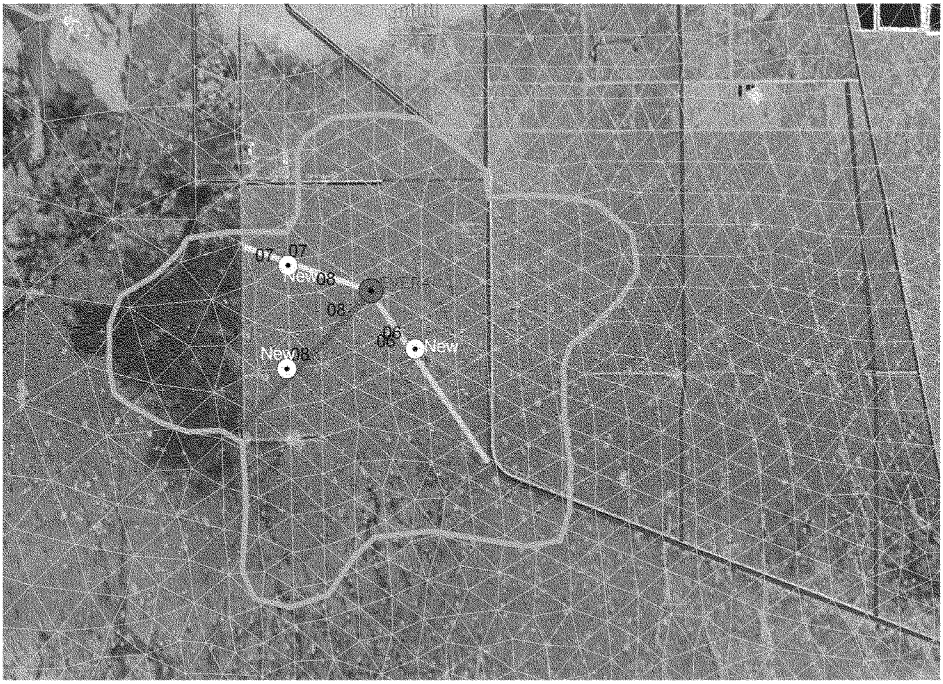

Figure 22. Location of existing (red) and recommended (green) vegetation transects and existing (EVER4) and recommended (white) stage monitoring wellpoints. Numbers (06-08) show locations of Cape Sable seaside sparrow nesting attempts documented by Lockwood *et al.* 2006 within subpopulation D critical habitat area. Sparrow helicopter monitoring grid points (+) and the District's Regional Surface Model cell mesh grid is also shown.

Enclosure 1
Florida Panther Habitat Assessment Methodology

Florida Panther Habitat Assessment Methodology

As of January 2005, the Service has been using a panther habitat suitability ranking system based in part on methods in publications by Swainson et al. (2005) and Kautz et al (2006) and adjusted by the Service to consolidate similar types of habitats and to include Comprehensive Everglades Restoration Plan water treatment and retention areas located in the panther's range (Table 1). Since the implementation of this ranking system, the Service has received two additional, published habitat assessment studies (Cox [2006] and Land et al [2008]) that further assess habitat usage by the Florida panther. As it is the Service's policy to incorporate the most current peer-reviewed science into our assessment and review of project effects on the Florida panther, we have revised the current habitat suitability ranking system.

To revise these values, the Service, in coordination with the Florida Fish and Wildlife Conservation Commission (FWC), examined the habitat ranking values in the two new papers referenced above and Kautz et al's (2006) publication and developed a spreadsheet. The spreadsheet was developed to: (1) compare the results of each of these published analyses; and (2) provide a habitat ranking system for each of the assessments. On the first page of the spreadsheet, labeled "Panther Habitat Selection Analysis - Habitat Papers Comparison," we summarized the types of analyses performed as to whether it was second order (selection of a home range with a large study area) or third order (selection of habitats within a home range). For each of these analyses, we then listed the habitat types reported in each paper and their order of selection by panthers (Table 2). We used the Cost Surface Scores and the Rank Differences from the Kautz et al. (2006) analyses as the selection order and for a measure of statistical differences among the habitat types. Selected habitat types are represented as bold black numbers and avoided habitats are bold red numbers. Habitats that were neither selected nor avoided are shown as normal font black numbers. Ranks with the same letter are not different from each other. Results from the Cox et al. (2006) and Land et al. (2008) papers using Euclidean analyses are shown in a similar fashion.

On the second page of the spreadsheet, labeled "Summary of Ranking Values," we ranked the habitat types on a scale from 0 to 10 according the results from each study and professional judgment (Table 3). We used our original ranking for the Kautz et al. analyses (with the ranking scale reversed such that the best habitat received a "10" and the lowest quality habitat was "0").

We developed similar rankings for the habitat analyses reported in Cox et al. (2006) and Land et al. (2008). Selected habitats fell in the range of 7 to 10; habitats that were used in proportion to availability were ranked from 4 to 6; and habitats that were avoided by panthers were ranked from 0 to 3. Ranks for habitats within each of the 3 outcomes began at the top of each of the ranges (selected = 10, used in proportion to availability = 6, avoided = 3). Some shifting of the ranks occurred based on the letter-coded statistical ranking. For instance, under "Land GPS Euclidean third order" both upland and wetland forests were selected by panthers and were not statistically different from each other (note the ranking of A and AB for upland and wetland forest, respectively). However, wetland forest and dry prairie also were not significantly different from each other. To show these relationships, we ranked upland forest as a 10, wetland forest as a 9, and we increased dry prairie from a 6 (top of the neither selected nor avoided ranking) to a 7 to reflect the interplay between dry prairie and wetland forest based on professional judgment.

To generate a new ranking of panther habitats for use as a habitat assessment measure, we simply averaged the ranks of the six different analyses presented in the spreadsheet to the first decimal place. Half of these results were second order habitat analyses (Kautz et al. compositional, Kautz et al. Euclidean, and Cox et al. Euclidean) and the other half were third order analyses (Cox et al. Euclidean, Land et al. VHF Euclidean, Land et al. GPS Euclidean).

In our assessment, we noted several outlier habitat rankings that, based on our understanding of habitat needs of the Florida panther and our concern for human/panther interactions, appear to provide conflicting values. These habitats and their associated rankings are: (1) Barren/Disturbed – 5.2; (2) Urban – 5.0; (3) Open water – 3.3; and (4) Coastal wetlands – 1.0. We believe adjustments are warranted for these four categories and our adjusted values are based on the following:

1. **Barren/Disturbed:** Barren/Disturbed lands may include many temporary changes to land use, such as crop rotation and prescribed fires that likely have little impact on the value to panthers. Areas disturbed by human impact on a longer-term basis (*e.g.*, parking of equipment and material storage areas) have chronic effects on panthers that we judge decrease the value of these lands for panthers. Barren/Disturbed lands include disturbed lands (FLUCCS 740) and spoil areas (FLUCCS 733). Based on the above reasons, we assigned barren/disturbed land a value of 3.

2. **Urban:** Panther habitat models typically include urban in the "other" category that was neither avoided nor selected by panthers. Highly urbanized areas are not found in the panther core area that was used in assessing habitat use as panthers have already selected against these land use types by reducing their range. However, urbanizing areas in more rural settings may appear in the assessment of habitat use. Nevertheless, we believe that potential human/panther interactions are important conflict factors to consider as well. Therefore, we assigned both developed rural and highly urbanized areas a value of 0.

3. **Open water:** Open water has been found to be either avoided by panthers or included in the "other" category that was neither avoided nor selected by panthers. We believe open water in any setting provides little to no value to panthers. However, open water edges and berms can be a valuable foraging area or dispersal pathway in more rural settings, although these edges in an urbanized setting could promote human/panther conflicts. Therefore, we assigned open water in an urban setting, with or without emergent vegetation, and surrounding berms a value of 0. However, in rural settings, the littoral edges and berms may provide species benefit and are further addressed under the reservoir discussion below.

4. **Coastal wetlands:** There are few strictly coastal wetlands, such as salt marshes and mangrove swamps, within the panther focus area. Where these occur, they are closely interspersed with other upland habitats. In this context, we believe that these areas are of greater value to the panther than the models indicate. These areas may, for the most part, be

avoided by panthers; but, they can be of value in the proper landscape context to higher value habitats. Therefore we assigned these areas a value of 3.

We also note that three additional land uses and or habitat types referenced in our original habitat rankings were not components addressed directly in the model. These include: (1) Exotic/Nuisance plants; (2) Storm Water Treatment Areas (STAs), and (3) Reservoirs. We believe these categories are important in our assessment of panther habitat values and warrant consideration in our habitat ranking system.

5. **Exotic/Nuisance plants:** Although exotic plants can be suitable for providing denning cover and habitat connectivity between other land types for panthers and panther prey, they generally do not provide the preferred foraging base of plants consumed by deer and other herbivores (Fleming et. al. 1994). We believe that prey foraging value, or lack of, is an important constraint in our habitat assessments. Therefore, we assigned these habitats a value of 3. Likewise, some native plant species can become so dominant and dense, especially under altered hydrologic and fire suppression regimes, that they no longer provide high habitat value for the panther even though occasional use may occur. The most common example is dense, nearly monotypic cattail stands, which are of reduced value relative to less altered marsh communities. Another example of this type of nuisance species dominance is dense stands of cabbage palm dominated communities. For systems represented by this habitat profile, we also assigned a value of 3.

6. **Storm Water Treatment Areas (STAs) (Everglades Restoration):** STAs are generally designed to provide a water quality treatment function for nutrient removal from received upstream discharges and may include multiple berms and adjacent littoral shelves. Depending on the design and mode of operation, they can become vegetated by dense monotypic stands of cattails or can incorporate a diverse mosaic of wetland communities and hydroperiods that support sawgrass and shrub/scrub species. Therefore, they can provide various levels of resource benefit to panthers and panther prey species as discussed below. For this reason, the final value of an STA is determined in a case-by-case basis during project review.

   The Service participates in planning efforts that encourage location of STAs at sites with minimal areas of natural habitat, with a preference for sites that are currently in agriculture. Because these facilities by design are located in areas that currently provide a reduced value to panthers and panther prey species, the Service values these systems pre and post project development as a neutral effect on panthers. In these situations, the development of an STA from existing agriculture land uses would be evaluated as if the agriculture land use was present following project development, with no increase or decrease in habitat value to the panther.

   However, this neutral effect assessment is only applicable to land conversions from nonnative habitats to STAs. For those projects that remove natural habitats, the Service considers STA functional values to mimic the value of the natural system the STA is designed to achieve. As an example, a STA design that results in a dense monotypic stand of cattails would be appropriately evaluated following the exotic/nuisance species profile. Similarly, a system designed to provide a diverse mosaic of wetland communities and hydroperiods would be evaluated following the wet prairie/marsh profile. Another system design that incorporates internal and external berms could include an edge benefit evaluation identifying the berms and adjacent littoral shelves and their benefit to the Florida panther and panther prey species, and follow the values provided for improved pasture for the berms and or wet prairie/marsh values for the littoral shelves. An individual project assessment of pre and post habitat impacts will identify whether the project as designed results in loss of functional value or provides benefit to the Florida panther and panther prey species.

7. **Reservoirs (Everglades Restoration, large water storage area, mines):** Reservoirs were classified as their own category in our 2003 assessment method. They differ from open water systems primarily with their location in the landscape. In urban areas, reservoirs have always been considered open water and given a value of 0. In rural areas, the open water portion of the reservoir provides no habitat value, although the edges and the berms can provide valuable foraging area or dispersal pathways for the panther and panther prey species. Therefore, the 2003 methodology assigned a value of 1.5 to reservoirs to attempt to account for these benefits.

   After further consideration, we believe that a more appropriate way to evaluate the value of reservoirs is to evaluate the open water component separately from the reservoir edges and berms. Therefore, we are no longer assigning a value to reservoirs as their own habitat classification. When large-scale reservoir projects are proposed in the rural landscape, all open water areas should be classified as such (value = 0). Berms and edges should be classified as the habitat they will most resemble in the post-project condition. For example: a 1,000-acre reservoir with 50 acres of grassed berms and 50 acres of berms with roads along the top would be evaluated as 900 acres of open water, 50 acres of pasture, and 50 acres of urban.

We also recognized that the habitat matrix (Table 4) lists four native habitats similar in functional habitat value to panthers as non-native habitats: marsh/wet prairie – 4.7; xeric scrub – 4.5; shrub and brush – 5.5; and dry prairie – 6.3. These habitat ratings, which are between 4 and 6, are classified as being neither selected nor avoided by panthers. The Service's Florida panther draft recovery plan's (Service 2008) action 1.1.1.2.3. recommends habitat preservation and restoration within the Primary Zone be provided in situations where land use intensification can not be avoided. We view this recommendation as a key parameter in our conservation goal to locate, preserve, and restore sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of a population of Florida panthers south of the Caloosahatchee River.

Therefore, for assessment purposes, if a project is proposing restoration of non-native habitats (*e.g.*, pasture, row crops, groves, etc) to native habitats, we believe that a restoration lift to a value of 7 is appropriate. The functional value of 7 corresponds to that value found in the literature where panthers begin to select for that habitat attribute (Table 3). We also believe that a full functional lift credit for these restorations is appropriate as the time lag from restoration to full functional value is estimated to be relatively short (less than 5 years) for non-forested systems. However, the calculation of forested restoration values remains the same as in the previous methodology, which is one half the difference between pre- and post-restoration.

In conclusion, we believe that appropriate adjustments to our original PHU values are warranted based on the most current peer-reviewed science and our category specific discussions above. Therefore, we have incorporated the above referenced values into our revised habitat assessment matrix and these values are the current basis for habitat evaluations and the recommended compensation values to minimize project effects to the Florida panther (Table 4).

Table 1. Original panther habitat unit values for use in assessing habitat value to the Florida panther.

Land Cover Type	Value	Land Cover Type	Value	Land Cover Type	Value
Water	0	STA	4.5	Cypress swamp	9
Urban	0	Shrub swamp	5	Sand pine scrub	9
Coastal strand	1	Shrub and brush	5	Sandhill	9
Reservoir	1.5	Dry prairie	6	Hardwood-Pine forest	9
Mangrove swamp	2	Grassland/pasture	7	Pine forest	9
Salt marsh	2	Freshwater marsh	9	Xeric oak scrub	10
Exotic/nuisance plants	3	Bottomland hardwood	9	Hardwood forest	10
Cropland	4	Bay swamp	9		
Orchards/groves	4	Hardwood swamp	9		

Panther Habitat Selection Analyses – Habitat Papers Comparison – Table 2

Habitats	Kautz compositional second order	rank	Kautz Euclidean second order	rank	Habitats	Cox Euclidean second order	rank	Cox Euclidean third order	rank	Habitats	Land VHF Euclidean third order	rank	Land GPS Euclidean third order	rank
Hardwood swamp	1	A	3	A	Coniferous forest	1	A	1	A	Upland forest	1	A	1	A
Pineland	2	A	2	AB	pineland					pine/hardwood				
Cypress swamp	3	AB	1	BC	Hardwood forest	3	C	2	A	hardwood hammock				
Upland forest	1	B	4	CD	hardwood hammock					pinelands				
Dry prairie	5	B	5	DE	mixed pine/hardwood					tropical hammock				
Shrub and brush	4	C	7	EF	palm/oak					palm/hardwood				
Xeric scrub	3	CD	9	F	tropical hammock					Wetland forest	2	A	2	AB
Marsh	5	CD	9	F	Forested wetland	2	B	3	A	cypress swamp				
Unimproved pasture	7	DE	7	G	cypress swamp					cypress/pine/palm				
Barren	6	E	9	G	mixed forest					mixed swamp				
Improved pasture	9	EF	6	G	shrub swamp					hardwood swamp				
Urban	8	F	8	G	hardwood swamp					Dry prairie/grass	3	B	3	BC
Cropland	9	F	8	H	other wet forest					grassland				
Citrus	10	G	8	H	Dry prairie/grass	4	C	4	B	unimproved pasture				
Coastal wetlands	11	G	8	H	dry prairie					improved pasture				
Open water	10	H	10	I	grassland					Marsh/shrub	6	B	4	C
Exotic plants					Open wetland	7	E	7	C	marsh/wet prairie				
STA					marsh and wet prairie					sawgrass				
Reservoir					sawgrass					cattail				
					cattail					shrub swamp				
					Agricultural	5	D	5	B	Other	4	B	5	C
second order - selection of home range with entire study area					improved pasture					open water				
third order - selection of habitats within home range					citrus					shrub/brush				
Bold (black) - habitat used more than availability (selection)					row crop					barren				
Bold (red) - habitat used less than availability (avoidance)					other agriculture					high impact urban				
rank - habitats with same letters did not differ in preference					Urban/barren	6	E	6	B	low impact urban				
					bare soil					extractive				
					high-impact urban					Agriculture	5	B	6	C
					low-impact urban					citrus				
					extractive					row crop				
										other agriculture				

Summary of Ranking Values – Table 3

Habitats	Kautz compositional second order	Kautz Euclidean second order	Cox Euclidean second order	Cox Euclidean third order	Land VHF Euclidean third order	Land GPS Euclidean third order	Average
Hardwood swamp	10	7	9	10	10	9	9.2
Pineland	9	8	10	10	10	10	9.5
Cypress swamp	8	9	9	10	10	9	9.2
Upland forest	10	6	8	10	10	10	9.0
Dry prairie	6	5	8	6	6	7	6.3
Shrub and brush	7	3	no data	no data	6	6	5.5
Xeric scrub	8	1	no data	no data	no data	no data	4.5
Marsh	6	1	6	3	6	6	4.7
Unimproved pasture	4	3	8	6	6	7	5.7
Barren	5	1	7	6	6	6	5.2
Improved pasture	2	4	7	6	6	6	5.2
Urban	3	2	7	6	6	6	5.0
Cropland	2	2	7	6	6	6	4.8
Citrus	1	2	7	6	6	6	4.7
Coastal wetlands	0	2	no data	no data	no data	no data	1.0
Open water	1	0	no data	no data	6	6	3.3
Exotic plants							
STA							
Reservoir							

habitat selection	7,8,9,10
neither selected nor avoided	4,5,6
habitat avoidance	0,1,2,3

Table 4. Revised panther habitat unit values for use in assessing habitat value to the Florida panther.

Land Cover Type	Value	Land Cover Type	Value	Land Cover Type	Value
Reservoirs	*	Xeric scrub	4.5	Dry prairie	6.3
STAs	**	Orchards/groves	4.7	Upland Hardwood Forest	9.0
Urban	0	Marsh/ wet prairie	4.7	Cypress swamp	9.2
Water	0	Cropland	4.8	Hardwood swamp	9.2
Barren/Disturbed lands	3	Improved pasture	5.2	Hardwood-Pine	9.3
Coastal wetlands	3	Shrub swamp/brush	5.5	Upland-Hydric Pine forest	9.5
Exotic/nuisance plants	3	Unimproved pasture	5.7		

* PHU values for reservoirs are evaluated based on open water for the main water areas and the appropriate categories for berms and other non-water sections. Refer to the accompanying text for guiding criteria for these systems.

** PHU values for stormwater treatment areas vary depending on design criteria, mode of operation, location in native or non-native habitats, and other landscape features. Refer to the accompanying text for guiding criteria for these systems.

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Enclosure 2
Snail Kite Survey Protocol

South Florida Ecological Services Office

DRAFT

May 18, 2004

Snail Kite Survey Protocol

A survey is necessary when the project site is within the snail kite consultation area and suitable habitat is present. The following criteria can be used to judge the adequacy of the habitat for snail kites.

1. Appropriate foraging habitat present [paspalidum (*Paspalidium geminatum*), spikerushes (*Eleocharis* spp.), panicum (*Panicum* spp.), or beakrushes (*Rhynchospora* spp.)].
2. Nesting or perching substrate present [willows (*Salix caroliniana*), melaleuca (*Melaleuca quinquenervia*), or pond cypress (*Taxodium ascendens*)] [sawgrass (*Cladium jamaicense*), cattail (*Typha* spp.), giant bulrush (*Scirpus validus*), or reed (*Phragmites australis*)].
3. Appropriate water depth (0.2-1.3 m deep) under nesting substrate.
4. Nesting substrate an adequate distance (>150 m) from upland.
5. Proximity of nearest wading bird colony.

If suitable habitat is present or snail kites are reported on site the following survey procedures should be used to document their occurrence. To maximize the chances of finding snail kites the survey should be conducted in January to May during the breeding season.

Record conditions in the suitable habitat including emergent vegetation types, nesting and perching substrate types, water depth in potential nesting areas, and distance from uplands.

A visual survey of suitable habitat should be made for birds and nests. A boat may be needed for the survey as the best nesting habitat may be a considerable distance (>150 m) from uplands. Check small trees, such as, willow, melaleuca, and pond cypress along the open water edge for nests or perching birds. If snail kites are observed, then nests can be located through the bird's behavior. When flushed from a nest the adult tends to circle upward, whereas non-nesting birds that are flushed fly more horizontally away from the disturbance (Bennetts et al. 1988). Nests also can be found by following kites carrying sticks, adults carrying apple snails, aerial courtship displays, vocalizations of adults or begging calls of the young, and through a thorough search of areas where adults are repeatedly observed (Bennetts et al. 1988).

When water levels are low snail kites may be forced to nest in vegetation along levees and roads. Check herbaceous vegetation, such as sawgrass, cattail, bulrush, and reed for nests. Record the location of all snail kites observed and describe their behavior. If nests are observed estimate the position of the nest (boat geographic position with direction and distance to nest) without approaching any closer than needed to reduce disturbance to the birds. Plot the location of nests on a map of the site.

Snail kites are highly gregarious and typically roost in colonies when not breeding. Birds found on perches that do not return to a nest site are most likely non-breeding. Follow these birds 1.5 to 2 hours before dusk to their roost location (Sykes 1982). Especially look for snail kites around sites with wading birds colonies (*e.g.*, anhingas and herons) nearby. Record the roost location, vegetation types, and number of snail kites at the site.

Where project activities, such as dredging, brush clearing, and herbicide treatment, may come within 130 m (425 ft) of nest or roost sites the area can be marked with PVC poles or poles with white balls on the top if aerial observation is necessary. The geographic coordinates of the markers should be obtained and marked on a site map. Project personnel should be informed to avoid marked areas and given a map indicating protective areas.

Because of the secretive nature of the snail kite and the need to differentiate breeding and non-breeding behavior surveys require specialized training. A qualified avian biologist/ecologist should be used to be to obtain acceptable results.

Snail Kite Monitoring Protocol

Every effort should be undertaken to avoid adverse effects to any snail kite observed during project activities. If it appears that these activities will alter breeding, feeding, or roosting behavior of snail kites, the activity must not be carried out until the proper action can be determined.

A pre-project activity survey should be conducted to learn foraging, feeding, and roosting patterns of the snail kite group on site. Document the location of all snail kites and describe their behavior.

Once project activities begin a monitor should be on site if activities are within 130 m (425 ft) of snail kite nests or roosts. Project activities should cease if the snail kites are disturbed. If disturbance is expected then an incidental take permit is needed.

At the end of project activities in the snail kite areas a monitoring report should be sent to the South Florida Ecological Services Office within 60 days.

A snail kite education plan can be used to help reduce the effects of a project on snail kites. All project associated personnel should be briefed as to the nature of snail kites and the potential impacts of the project on them. The plan should include:

1. A description of the snail kite, its habits, and protection under Federal law;
2. Instruction not to injure, harm, harass, or kill this species or possess any part thereof (*e.g.*, feathers, eggs, and nest);
3. Instructions to cease project activities if a snail kite nest or roost is found with 130 m (425 ft) of project activities; and
4. Telephone numbers of pertinent agencies to contact if snail kite is found dead.

If an on-site monitor is needed they should have the following qualifications:

1. A qualified avian biologist/ecologist;
2. Demonstrate their familiarity with south Florida raptor species and have prior south Florida;
3. Raptor survey and monitoring observational experience; and
4. Have authority to cease all project related activities that may appear to alter breeding, feeding, or roosting behavior of snail kites.

Activities can resume if the birds leave the area or when the nestlings have fledged.

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Enclosure 3
Draft Snail Kite Management Guidelines

U.S. Fish and Wildlife Service

Draft Snail Kite Management Guidelines
February 21, 2006

These guidelines were developed to help resource managers and other interested parties avoid detrimental impacts to endangered Everglade snail kites and their habitat, and to provide information that will allow managers to improve conditions for snail kites. Everglade snail kites are listed as endangered under Federal and Florida State laws. Any disturbance to snail kites or their nests, including flushing perched birds, interrupting foraging, flushing adults from nest sites, interfering with feeding and protection of nestling kites, and impacting vegetation that supports kite nests is prohibited. Adherence to these guidelines will minimize the likelihood that actions result in prohibited impacts to snail kites. If you see snail kites, we always recommend that you simply avoid the immediate area where kites are present. If in doubt about whether an activity may affect kites, please contact a U.S. fish and Wildlife Service (Service) or Florida Fish and Wildlife Conservation Commission (FWC) office.

MINIMIZING IMPACTS TO KITE NESTING DURING BREEDING SEASON

During each nesting season (generally December 1 to July 31, but including all periods when active nests are known), locations of all known snail kite nests will be provided to the Service from researchers and resource managers, and then distributed to appropriate agency representatives. Maps and coordinates of nest sites, kite protection buffers, and priority kite management zones will be distributed to established points of contact for agencies and organizations that conduct management actions in kite habitat. These points of contact will be responsible for disseminating the information to personnel working on the ground.

Nest Protection Buffers

Two buffer zones will be established around every active snail kite nest. This includes all nests reported to the Service by researchers and any unreported nest that is encountered during other activities. These buffer zones will be in effect from when kites begin nest building through the time when breeding activity is no longer observed at the site. Because kites can renest, and often renest in the same area as previous attempts, buffer zones may remain in place past the time when fledglings leave the area if adult kites continue to show breeding activity, including courtship, in the general area. Kites do not exhibit fidelity to a specific nest site from year to year. Consequently, all restrictions within these buffer zones will be lifted once breeding activity has ceased.

1. No-entry Buffer Zones - A 500-foot (ft) (~150 meter) radius no-entry buffer zone will be established around all active nests that are discovered. The purpose of this buffer zone is to protect kites from direct disturbance that may affect the fate of nesting.

- Airboats, personnel, helicopters, and other equipment and activity must stay outside of these areas at all times when kite breeding activity is occurring.
- These buffers are slightly larger than the estimate of 430 ft (131 m) recommended in a study of disturbance to birds from airboats (Rodgers and Schwikert 2003). This larger buffer was selected because the disturbance tested in their study does not necessarily represent the types of activity that may occur during land management activities because they monitored the responses of perched birds and not nesting birds.

2. Limited Activity Buffer Zones - A 1,640 ft (500 meter) radius limited-activity buffer zone will be established around all active kite nests. This buffer zone is intended to maintain and protect foraging opportunities and habitat conditions around each nest to allow the nest to succeed. The goal is to maintain habitat conditions for the entire nesting period similar to those that were present when the birds selected the site.

- Airboats, personnel, helicopters, and other equipment and activity should stay outside of this buffer when possible, and activity within the buffer should be limited to the minimum time necessary to complete appropriate management activities.
- Only management activities that are expected to maintain or improve the existing kite foraging and nesting habitat within these areas should occur while there is evidence of kite breeding activity.
  - Exotic and invasive plant control efforts, including water hyacinth, water lettuce, and hydrilla, and similar invasive species that may rapidly encroach on native vegetation communities may be treated within limited-activity buffer zones during kite breeding, so long as treatments are not expected to result in impacts to vegetation species that contribute to snail kite and apple snail habitat. Treatments expected to result in changes > 10 percent in the cover or occurrence of native vegetation species including spike rushes, bulrushes, maidencane, and other emergent vegetation should be avoided.
  - Treatments of invasive and undesirable woody plants, cattails, tussocks, and other similar vegetation should not occur within these buffer zones during kite nesting. These treatments should be postponed until after kite breeding activity has ceased.
  - These buffer distances are intended to encompass the primary foraging area around a nest. The buffer distance is larger than the 820 ft (250 meter) radius recommended by Sykes (1987), and is a better representation of the area that kites use for foraging during nesting.

Priority Kite Management Areas

Snail kite nesting does not occur randomly within wetland systems. Instead, there are generally areas within wetlands, where kite nesting is concentrated. The density of kite nests, frequency of nesting within each area, and the sizes of these "priority kite nesting areas" are highly variable, but identifying these areas may help resource managers to focus management actions. In most years, the majority of kite nesting will occur within these areas, though new nesting areas may become active. At the end of each nesting season, primary kite nesting areas will be delineated based on the current year's nest locations and nesting in the previous 10 years.

- The polygons that delineate priority kite nesting areas, are 'kernels' that represent the 90 percent probability density function for kite nests over a 10-year period (1996-2005 in this case). These polygons were delineated under the assumption that the density of kite nests over the past 10 years indicates the likelihood of future kite nesting, and approximately 90 percent of the kite nesting, on average, will occur within these polygons if patterns of nest site selection continue as in the past.
- These areas will be provided to agency representatives soon after the end of the kite breeding season (July), and represent areas where resource management activities are likely to be limited due to kite nesting activity. Proposed management actions should incorporate pre-treatment kite surveys, or avoid these areas during the early part of the following breeding season (from January 1 to May 31) when kites are selecting nesting

sites. These also represent the areas where proactive management for snail kite foraging habitat may be most beneficial.

- This information will be provided (in most years) several months prior to the beginning of the kite breeding season to allow land managers to avoid impacts to kite nesting through early planning by timing proposed treatments in these areas to avoid critical periods for kites.
- The extent of these areas will generally not change dramatically from year-to-year.
- Management actions do not have to be excluded from these areas during the entire nesting season, but surveys for kite nesting activity should be conducted prior to working in these areas during the kite nesting season, and avoiding work in these areas during the breeding season is recommended whenever possible.
- There is good potential for kite nesting to occur outside of these areas, and resource managers should always look for evidence of snail kites and kite breeding activity prior to conducting management actions.

MANAGING FOR SNAIL KITE HABITAT

Active management of wetlands to benefit snail kites has not been regularly conducted. However, there are several actions and considerations that resource managers can adopt that may benefit snail kites.

- Foraging habitat – maintaining Florida apple snail populations, and the vegetation types that support healthy Florida apple snail populations is critically important to maintaining snail kite habitat. Not all areas where there are abundant apple snails support snail kite nesting, but most of these areas provide foraging habitat for snail kites at some time.
    - Shallow wetlands with emergent vegetation such as spike rush, bulrush, and other native emergent wetland plant species provide good snail kite foraging habitat as long as the vegetation is not so dense that kites would have difficulty locating apple snails. The specific conditions and vegetation species that provide good snail kite foraging habitat vary depending on the specific conditions of each wetland (lake or marsh, variability in water depths, soil characteristics, etc.).
    - Control of exotic and invasive plant species such as water hyacinth and water lettuce may be necessary to maintain the open character of vegetation within kite foraging habitat.
    - Non-native species of apple snails may provide forage for snail kites. However, initial evidence suggests that these species are not consistent with maintaining sustainable wetland communities. Maintaining a healthy population of Florida's native apple snail, and working to control non-native snail species is a more sustainable management strategy.
- Nesting habitat – kites are not particularly discriminating about their nest sites, and they may nest in a wide variety of substrates and situations. However, kite nests are generally most successful in low woody species such as willow, buttonbush, pond apple, and other wetland shrubs that remain inundated for the entire nesting period, and efforts to maintain or produce favorable nesting sites may help maintain kite nesting.
    - Planting woody wetland species in areas that support snail kite foraging habitat and do not dry out completely during the kite breeding season may facilitate snail kite nesting and nest success. Any planted woody vegetation should be managed for long-term persistence.

- Nests that occur in dense cattails, bulrush, and other herbaceous species are more vulnerable to collapse than those in woody substrates.
- Potential nesting areas that dry out during the nesting period are vulnerable to land-based predators such as raccoons.
- Nesting areas are almost always located within areas of good foraging habitat.
- Invasive and exotic woody vegetation may be used by snail kites as nesting substrate, but these species are not components of sustainable snail kite habitat. Controlling invasive and exotic woody vegetation outside of snail kite nesting season, and replanting with native wetland woody plant species where needed will be a more effective long-term strategy for managing snail kite nesting habitat.

- Managing hydroperiod – Changes in water regimes and depth and duration of inundation are important characteristics for wetland vegetation that supports snail kite nesting and foraging habitat, Florida apple snails, and all aspects of snail kite and apple snail life history.
  - Continuous inundation and stabilized water levels for long periods will probably result in unfavorable vegetation conditions.
  - Long periods of drying (> 1-2 months) will detrimentally affect Florida apple snail populations, and reduce the likelihood of use by snail kites. However, occasional drying for shorter periods may be beneficial.
  - Rapid changes and large changes in the depth of water within wetlands have the potential to detrimentally affect kite nesting and apple snail populations.
    - Rapid and/or large drops in water level increase the risk of snail kite nest predation by drying out the substrate beneath nests and allowing land-based predators to access nests.
    - Rapid and/or large increases in water depth may detrimentally affect desirable vegetation, and can flood out Florida apple snail eggs, leading to reductions in apple snail populations and reduced snail kite foraging.

COMMENTS, FEEDBACK, AND NEW INFORMATION

We always request feedback, new information, and recommendations for improving guidelines and snail kite management from resource managers and on-the-ground crews.

- We request that individuals report snail kite nesting activity outside of documented nesting areas.
- We welcome questions about managing snail kites, snail kite habitat, and apple snail populations.
- Additional information about snail kites and their habitat can be found at the Service's South Florida Ecological Services Office web site at: http://www.fws.gov/verobeach/index.htm
- Questions, comments, and inquiries can be directed to Tylan Dean by e-mailing: Tylan_Dean@fws.gov, or by calling (772) 562-3909, extension 284.

LITERATURE CITED

Rodgers, J.A. Jr. and S.T. Schwikert. 2003. Buffer zone distances to protect foraging and loafing waterbirds from disturbance by airboats in Florida. Waterbirds 26(4):437-443.

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ANNEX B
NEPA INFORMATION

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B.0 NATIONAL ENVIRONMENTAL POLICY ACT INFORMATION

B.1 SUMMARY OF ENVIRONMENTAL COMPLIANCE

SECTION 9 provides detailed information regarding environmental compliance activities. ***TABLE B-1*** below provides a summary of compliance and coordination for environmental statutes and regulations.

TABLE B-1: **ENVIRONMENTAL COMPLIANCE AND COORDINATION**

Law, Regulation or Policy	Status*	Comments	Last Coordinated	Full Compliance Expected
Clean Air Act of 1972	PC	PIR/EIS will be coordinated with public agencies. Air emissions permit may be required for large diesel pumps; normally applied for during PED phase.	C&SF Restudy 1999	Compliance with Section 176 of CAA will occur with the coordination and review of the PIR/EIS by EPA.
Clean Water Act of 1972	PC	404 (b) (1) Evaluation has been prepared (Annex B). For the C-111 SC project; WQC will be required; (State permit); NPDES permit will be required (State delegation); water quality is expected to improve with project.	Informal coordination with FDEP through participation in PDT meetings.	Full compliance upon issuance of the WQC and NPDES permits by the state.
National Environmental Policy Act of 1969	PC	NOI published; scoping meetings held; no new issues have been identified; NOA for the draft PIR/EIS for C-111 SC project was published in FR on 24 April.	NOI for C-111 SC on 16 May 2002; Scoping letter sent on 7 May 2002.	Full compliance upon coordination of the final PIR/EIS, public outreach activities completed and signing of the ROD.
Fish and Wildlife Coordination Act of 1958	C	Funds transferred annually to FWS; PALs received; FWS and NMFS active team participants and have provided info on	Ongoing. FWS and NMFS have participated in PDT meetings and creation of FSM document.	In July 2009 FWS submitted a final Coordination Act Report for the C-111 SC project. This project is in

		fish and wildlife elements on project.	PALs received dated 16 Dec 02; 30 Sep 03; 12 Feb 04; 24 Mar 05 and 22 Nov 05. Draft FWCA report due March 2009.	full compliance with this act.
Endangered Species Act of 1973	C	List of affected species has been confirmed. Coordination with both FWS and NMFS is ongoing.	Confirmation of threatened and endangered species by letter dated, 17 June 2008. On 8 August 2009, the NMFS recommended a "no effect" determination on species of their purview. Received Biological Opinion on August 25, 20009.	The Biological Opinion was received and formal consultation is complete. This project is in full compliance with the Act.
Magnuson-Stevens Fishery Mgt Act	C	Overall project is expected to benefit Essential Fish Habitat; NOAA will accept Draft EIS as the EFH assessment.	Informal coordination with NOAA representative at PDT meetings.	Through personal correspondence, the NMFS has concluded no impacts to EFH, therefore, this project is in full compliance with this act.
Fishery Conservation and Management Act	PC	The project is being coordinated with NMFS	Informal coordination with NOAA representative at PDT meetings	Full compliance after review of the final PIR/EIS by NMFS.
Coastal Zone Management Act o f 1972	PC	Based on a review of the May 2002 scoping notice and comments provided by state reviewing agencies, the state has	May 2002	Additional consistency review by the state will occur during coordination of

		determined that, at this stage, the project is consistent with the Florida Coastal Management Program.		the final PIR/EIS. Full compliance will occur with issuance of the WQC by the state.
Coastal Barrier Resources Act and Coastal Barrier Improvement Act	NA	There are no designated coastal barrier resources in the project area that would be affected by this project. These Acts do not apply.		
Marine Mammal Protection Act of 1972	PC	The West Indian Manatee does occur near some of the project sites. Incorporation of the safeguards used to protect Threatened and Endangered species during construction and operation would protect any marine mammals in the area. Coordination with the FWS will continue as construction and operational guidelines are incorporated to avoid impacts to this species.	May 2002 and coordination through PDT meetings.	Full compliance after review of the final PIR/EIS by FWS.
Marine Protection, Research and Sanctuaries Act	NA	The term “dumping” as defined in the Act (3[33 U.S.C. 1402](f)) does not apply to this project. Therefore the MPRSA does not apply.		
Estuary Protection Act of 1968	PC	It is anticipated that estuaries would be positively affected by this project.	May 2002 and coordination through PDT meetings.	Full compliance after review of the final PIR/EIS by NMFS.
Anadromous Fish	PC	Anadromous fish species would not	May 2002 and coordination	Full compliance after review of the

Conservation Act		likely be affected. The project is being coordinated with NMFS.	through PDT meetings.	final PIR/EIS by NMFS.
Migratory Bird Treaty Act and Migratory Bird Conservation Act	PC	No migratory birds would likely be affected by project activities.		Full compliance after review of the final PIR/EIS by FWS.
Wild and Scenic River Act of 1968	NA	No designated Wild and Scenic river reaches would be affected by project related activities.		
Federal Water Project Recreation Act	C	The principles of this Act (PL 89-72) have been fulfilled by complying with the recreation cost sharing criteria.		
Submerged Lands Act of 1953	PC	The project would eliminate point source freshwater discharges and provide freshwater overland flow that will ultimately benefit the ecological habitats that occur on submerged lands of the State of Florida. No construction is expected on submerged lands; therefore, full compliance is anticipated.		Full compliance by completion of final PIR/EIS.
Rivers and Harbors Act of 1899	NA	The proposed work would not obstruct navigable waters of the United States.		
National Historic Preservation	C	SHPO coordination has been initiated; Phase I survey	In a letter dated February 13, 2009,	This project is in full compliance with this Act.

Act of 1966 and the Archeology and Historic Preservation Act		indicated some resources are present, but not eligible for National Register for Historic Places.	consultation with the Florida State Historical Preservation Officer has determined no effect on any significant cultural resources.	
RCRA, CERCLA, TSCA, FIFRA	C	On-site contaminants are below threshold levels requiring management as hazardous wastes; soil management plan will prevent adverse ecological effects.	Contamination investigations and soil management plan have been developed in consultation with FDEP and USFWS.	This project is in full compliance with applicable sections of these Acts.
Farmland Protection Policy Act of 1981	C	Consultation with NRCS has determined no Prime Farmland Soils are within the project area.		This project is in full compliance with this Act.
Executive Order 11988 Floodplain Management	PC	(Floodplain Development). The areas for proposed restoration in the project area are virtually all considered floodplain. The purpose of the E.O. is to discourage federally induced development in floodplains. Commitment of lands to project restoration will preclude such development.	Ongoing	Full compliance expected after completion of the final PIR/EIS
Executive Order 11990 Protection of Wetlands	PC	(Wetlands protection) The areas proposed for restoration are a combination of freshwater and coastal wetlands. A net	Ongoing. Habitat mapping and other analysis of wetlands.	Full compliance after final PIR/EIS.

		functional "lift" is expected.		
Executive Order 12898 Environmental Justice	C	The team is in compliance for this phase of the study, as no minority or economically disadvantaged population clusters have been identified in the immediate southern Dade County region where the spreader canal features are proposed.	1999 Restudy	This project is in full compliance with this E.O.
Executive Order 13089 Coral Reef Protection	PC	This project is expected to provide overall benefits to hard bottom communities and coral reef resources.	May 2002 and coordination through PDT meetings.	Full compliance after review of the final PIR/EIS by NMFS.
Executive Order 13112 Invasive Species	PC	Project is expected to reduce the abundance and variety of invasive plant species in the project area.	Ongoing coordination with FWS and DERM.	Full compliance after final PIR/EIS.
Executive Order 13186 Migratory Birds	C	No migratory birds would be affected by project activities.	Ongoing coordination with FWS	The project is in compliance with this Executive Order.

* Key: C Complies fully
NC non-compliant
NA not applicable
PC partial compliance due to plan development

B.2 CLEAN WATER ACT SECTION 404(b)(1) EVALUATION

B.2.1 Project Description

B.2.1.1 Location

The C-111 Canal is the southernmost canal of the Central and South Florida (C&SF) Flood Control project and is located in south Miami-Dade County. The canal serves a basin of approximately 100-square-miles and functions primarily to provide flood protection and drainage for the agricultural areas to the west and south of Homestead, Florida. Southwest of Homestead and Florida City and just south of the agriculturally developed area, the C-111 Canal is joined by C-111E and courses south to southeast through extensive marl wetland prairie and coastal mangrove marsh before it ends in Manatee Bay. The C-111 Canal and S-18C (located just south of the confluence of C-111E and C-111) were completed in 1966 and the S-197 structure was completed in 1970. S-197 provides a gravity outlet for stormwater runoff during flood conditions and acts as a barrier to prevent saltwater intrusion into the freshwater wetlands of the Southern Glades Wildlife and Environmental Area (SGWEA) located to the north of the Everglades National Park's (ENP) eastern panhandle. The C-111 Canal is also the final segment of the South Dade Conveyance System (SDCS) for maintaining water supply and flood protection. The C-111 Canal also provides a means to deliver water to ENP's Taylor Slough and the eastern panhandle area to meet the minimum water delivery schedule, under Federal Statute (Public Law [P.L.] 91-282).

B.2.1.2 Alternative Formulation

The plan formulation process went through several iterations to arrive at a Recommended Plan. Management measures were formulated based on prior planning efforts to produce a total of 22 conceptual alternatives. After a series of Project Delivery Team meetings, the project was split into a two-PIR effort due to environmental concerns and risk and uncertainty. New objectives were formulated for the first project to be implemented, the C-111 SC Western project, and a new, revised set of Initial Array of Alternatives were formulated. These alternatives were then modeled and screened.

After the initial screening of the Initial Array of Alternatives and consolidation described above, five alternatives remained as well as the future-without project condition. One plan, Alternative 2D, was then optimized into two different alternatives, 2DS and 2DL. Hydrologic modeling was then conducted, and costs and habitat units were calculated in order to conduct the Cost Effectiveness/Incremental Cost Analysis (CE/ICA) and plan comparison. As a result, the team conducted a second screening process and four alternatives (1C, 1D, 2DL, and 3D) were eliminated, leaving three remaining plans to evaluate.

For the final analysis, the No-Action Alternative, 2DS, and 6D were compared employing criteria such as cost effectiveness, risk and uncertainty, relationship to objectives and constraints, P&G criteria, etc. An evaluation was also conducted utilizing the four Evaluation Accounts, National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RDE), and Other Social Effects (OSE). Upon completion of the comparison, Alternative 2DS was determined to be both cost effective and a best buy as well as the NER plan. As such, Alternative 2DS was selected as the Recommended Plan.

B.2.1.3 General Description

The main goal of the C-111 Spreader Canal (C-111 SC) Western project is to improve the quantity, timing, and distribution of water delivered to Eastern Florida Bay via Taylor Slough. It is anticipated that these improvements will be realized through the establishment of a hydraulic ridge between Taylor Slough and the C-111 Canal, which will reduce seepage from Taylor Slough, and from its headwaters. The seepage-reducing hydraulic ridge will be established by diverting water that is currently being discharged through S-177, S-18C and S-197 into two separate linear detention areas to be constructed within the South Florida Water Management District (SFWMD) owned lands. Other components in the Recommended Plan are geared towards providing a jump start for the main restoration that would be targeted for restoration in the C-111 SC Eastern project.

B.2.1.4 **Authority and Purpose**

The C-111 SC project was formulated and authorized as part of the Central and Southern Florida Project Comprehensive Review Study. The Central and Southern Florida Project Comprehensive Review Study, known as the Restudy, was authorized by Section 309 (1) of the Water Resources Development Act (WRDA) of 1992 (P.L. 102-580). This study was also authorized by two resolutions of the Committee on Transportation and Infrastructure, United States House of Representatives, dated September 24, 1992. Further, Section 528 of WRDA 1996 provided specific direction and guidance for the Restudy. The Comprehensive Everglades Restoration Plan (CERP) was authorized by Section 601 of the WRDA 2000 (P.L. 106-541), as a framework and guide for modifications to the C&SF project to restore the south Florida ecosystem and to provide for the other water-related needs of the region.

The primary restoration purpose for the C-111 SC Western project is to restore the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough of ENP. Hydropatterns and hydroperiods in the Model Lands and Southern Glades would also be restored. Lastly, salinities in the estuaries downstream of Taylor Slough would be reduced.

The specific objectives of the C-111 SC Western project are as follows:

- Restore the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough to levels nearest as possible to the pre-drainage model runs;
- Improve hydroperiods and hydropatterns in the Southern Glades and Model Lands. The hydroperiods will be improved to optimal levels to support historical vegetation patterns nearest as possible to the pre-drainage model runs; Hydropatterns will be restored to historical sloughs and associated tributaries.
- Return coastal zone salinities in western Florida Bay to levels as close as possible to pre-drainage scenario model runs by restoring upstream water levels in eastern Everglades National Park.

The C-111 SC Western PIR components will be divided into north and south sections with Ingraham Highway as the division boundary. The main north components include the Frog Pond Detention Area, the Frog Pond Header Canal, and Pump Station PS-1 (***FIGURE B-1***). The main south components include Pump Station PS-2, the Aerojet Canal extension, the plugs on the Aerojet, C-110, and L-31E Canals, and the water control structure S-197B (***FIGURE B-2***).

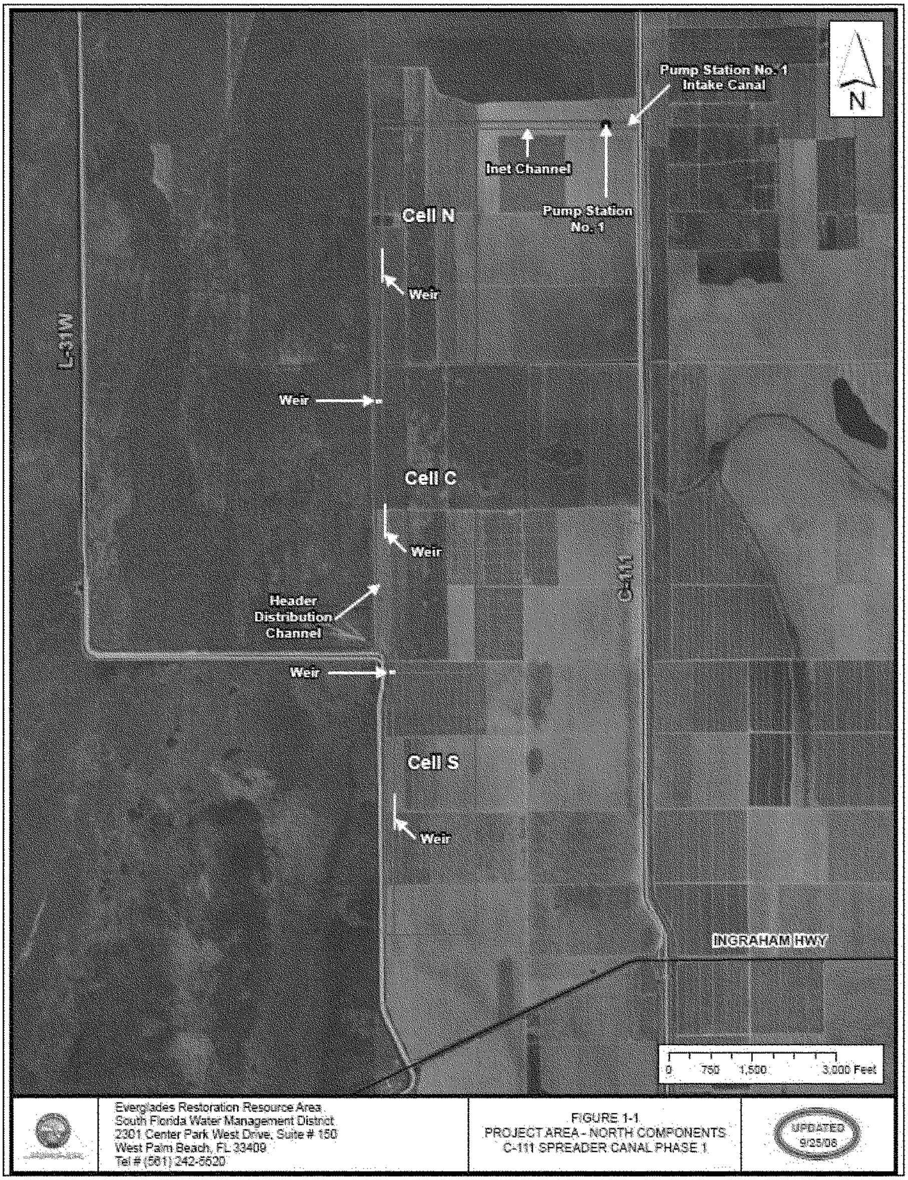

FIGURE B-1: PROJECT AREA NORTH COMPONENT

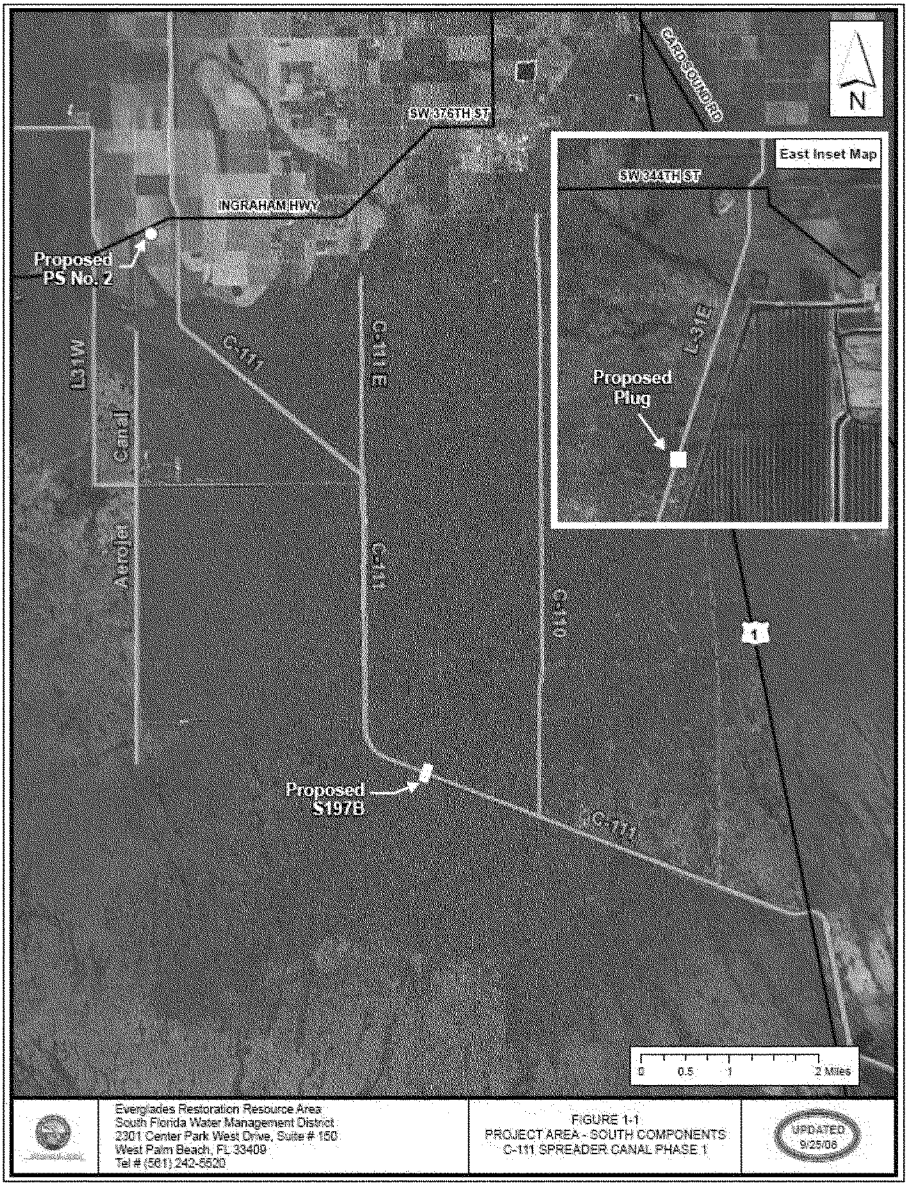

FIGURE B-2: PROJECT AREA SOUTH COMPONENT

B.2.1.5 General Description of Dredged or Fill Material

B.2.1.5.1 General Characteristics of Material

Fill for the construction of the perimeter and intermediate levees will be a well graded mixture of silty sands and gravels as that found in the detention area (existing surficial soils).

B.2.1.5.2 Quantity of Material

Total volume of surficial topsoil to be excavated is 702,100 cubic yards, which includes topsoil scraped for site preparation of Frog Pond Detention Area and Aerojet Canal Impoundment project features. Total volume of limerock to be excavated is 6,000 cubic yards, which includes limerock excavated for construction of S-200, S-199 and their associated intake channels. Total volume of limerock spoil material along the east and west banks of the C-110 Canal to be used for the construction of ten plugs in the C-110 Canal is 207,000 cubic yards. No dredging will be required within the C-110 Canal for the construction of S-198; borrow material on both sides of the canal will be used to construct the proposed ten plugs for C-110.

B.2.1.5.3 Source of Material

The fill will be suitable material from on-site borrow sources or others areas as designated by the SFWMD.

B.2.1.6 Description of the Proposed Discharge Site

B.2.1.6.1 Location

Excess excavated material will be temporarily stockpiled on-site and then used for the construction of project features.

B.2.1.6.2 Size

The total area of work in, on, or over wetlands or other surface waters is 103.59 acres:

- Frog Pond Detention Area and S-200 0.65 acres
- Aerojet Canal Impoundment and S-199 28.05 acres
- C-110 Canal Plugging 71.08 acres
- L-31 E Canal Plugging 0.46 acres
- S-198 Water Control Structure 3.34 acres

B.2.1.6.3 Type of Site

The site of the proposed Frog Pond Detention Area is located on land that is currently be used for farming, aquaculture, and managed for hunting. The land is low-lying and very flat, with natural elevations generally less than one meter above sea level. The northern most section of the Aerojet features are also located in developed areas, while the southern section is located in unconfined, intermittently flooded wetland. The L-31E and C-110 are canals surrounded by seasonally flooded wetlands, and the S-198 Water Control Structure will be constructed in C-111, a canal also located in seasonally flooded wetlands.

B.2.1.6.4 Type of Habitat

The soils are in the project area are predominantly marl, mixed with and grading into peat soils near the coastline. Undeveloped areas contain mainly wetland vegetation, plus disturbed, rural upland areas with roads, levees, canals and other man-made features. For a more detailed description of the environmental setting, see ***SECTION 5*** of the Biological Assessment (***ANNEX A*** of this document).

B.2.1.6.5 Timing and Duration of Discharge

Project construction is scheduled to begin in 2009 under the State Expedited Construction program (pending receipt of all required permits and authorizations) and take approximately three years to complete.

B.2.1.7 **Description of Disposal Method**

Fill material will be trucked to the project location; dumped, moved, shaped and compacted with earthmoving equipment.

B.2.2 Factual Determinations

B.2.2.1 **Physical Substrate Determinations**

B.2.2.1.1 Substrate Elevation and Slope

The natural topography of the area is nearly flat with slopes less than two percent, with the exception of the unnatural features (canals and levee).

B.2.2.1.2 Sediment Type

The substrate at the project sites is primarily limestone rock overlaid with marl soil.

B.2.2.1.3 Dredge/Fill Material Movement

There should be no appreciable movement of fill material. Fill material will rest on limestone rock, and the design plans will include erosion, sediment and turbidity control measures.

B.2.2.1.4 Physical Effects on Benthos

Benthic organisms in the excavation and fill areas will be eliminated.

B.2.2.1.5 Water Circulation, Fluctuation, and Salinity Determinations

B.2.2.1.5.1 Water Column Effects

During construction of project features excavation activities, the water column in the immediate area may become temporarily more turbid. No long term effects on the water column are expected.

B.2.2.1.5.2 Current Patterns and Circulation

Construction of the project features is not expected to affect current patterns or circulation.

B.2.2.1.5.3 Normal Water Level Fluctuations and Salinity Gradients

Construction activities would not affect normal water level fluctuations or salinity gradients. Implementation of the project would help to modify the salinity released to Florida Bay. The salinity gradient would be somewhat modified to a more ecologically appropriate level.

B.2.2.2 **Suspended Particulate/Turbidity Determinations**

B.2.2.2.1 Expected Changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Disposal Site

Suspended particulate/turbidity would be limited to construction footprint during construction period. There should be no turbidity in canals or downstream wetlands as a result of the project. Best management practices (BMPs) would be used to minimize the suspension and transport of soils, levee materials, and roadway materials into water adjacent to or downstream of the construction area including use of sediment controls for adjacent wetlands.

B.2.2.2.2 Effects on Chemical and Physical Properties of the Water Column

In general, any short-term impacts to water quality associated with construction of the project would be ameliorated by construction sequencing, BMPs for erosion and sedimentation control and monitoring during construction. Longer-term impacts to water quality associated with the operation of project features would be addressed through operational monitoring and adaptive management actions, if potentially adverse affects are observed or predicted.

B.2.2.2.2.1 Light Penetration

During construction operations there would be a temporary reduction in light penetration in the canals in the immediate vicinity of the activity. Once construction is complete, light penetration is expected to return to pre-construction levels.

B.2.2.2.2.2 Dissolved Oxygen

During construction operations there would be a temporary reduction in the dissolved oxygen content in the water column in the immediate vicinity of the activity. Once construction is complete, dissolved oxygen is expected to return to pre-construction levels.

B.2.2.2.2.3 Toxic Metals, Organics, and Pathogens

No toxic metals, organics, or pathogens would be released by project construction.

B.2.2.2.2.4 Aesthetics

During construction, visual aesthetics would be negatively impacted. After completion, aesthetics would improve due to a reduction in exotic species.

B.2.2.2.3 Effects on Biota

B.2.2.2.3.1 Primary Productivity and Photosynthesis

Disposal of excavated materials would adversely affect wetlands in the immediate vicinity of construction by destroying vegetation and smothering biota. However, project operation would improve the primary productivity and photosynthesis due to an increase in quality of wetland habitat.

B.2.2.2.3.2 Suspension/Filter Feeders

During construction operations there would be a temporary increase in turbidity and possibly a decrease in suspension/filter feeders due to construction activities. This temporary increase in turbidity will be short-term and should not have any long-term negative impact on these highly fecund organisms. The implementation of the project should benefit these organisms by creating a better quality wetland habitat.

B.2.2.2.3.3 Sight Feeders

During construction operations there would be a temporary increase in turbidity and possibly a decrease in sight feeders due to construction activities. No significant impacts on these organisms are expected as the majority of sight feeders are highly mobile and can move outside the affected area. These organisms would benefit when the project is operated due to a better quality wetland habitat.

B.2.2.3 **Contamination Determinations**

Limited Phase I Environmental Site Assessments conducted over 6,770 acres within the proposed project footprint identified approximately 4,186 acres of former agricultural lands. Subsequent soil quality evaluations conducted on the former agricultural lands indicated that detectable levels of residual agrochemicals were present within portions of the former agricultural lands including barium, cadmium, chromium, copper, lead, zinc, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane and endosulfan. As described in ***TABLE B-2***, all of these substances were present at concentrations well below federal or state regulatory levels for agricultural (commercial & industrial) land uses though there were some concentration levels that exceed FDEPs sediment quality assessment guidelines (SQAGs), which are typically used as screening values to determine the ecological implications of inundating project lands. In accordance with the jointly (USFWS, FDEP, and SFWMD) developed "Protocol for Assessment, Remediation, and Post-remediation Monitoring for Environmental Contamination on Everglades Restoration Projects" (SFWMD, 2008), lands which exceeded the SQAG for one or more parameters were then subjected to a Screening Level Ecological Risk Assessment (SLERA).

Based on the results of a screening level ecological risk assessment (SLERA), the USFWS concluded that hydration of the soils within portions of former agricultural lands known as the Frog Pond posed potential risks to USFWS Trust Species (i.e., species protected by the Endangered Species Act or the Migratory Bird Treaty Act). Specifically, the USFWS concluded that 4,4-DDE, copper, and zinc pose a potential risk to the Snail Kite, and 4,4-DDE poses a potential risk to the Osprey.

The removal of existing surficial soils is integral to the design of the project as a cost-effective measure to permanently reduce or eliminate exotic and nuisance vegetation and as a means to provide a stable subgrade for support of the proposed levees and structures. Therefore Soil Management Plans (***APPENDIX A***) were developed in order to reconcile the project's inherent soil excavation plans, which are integral to the design, with HTRW concerns. The Soil Management Plans were developed in consultation with and reviewed by the USFWS and the Florida Department of Environmental Protection (FDEP).

The USFWS concurs that the project's inherent removal of soils has a secondary benefit of eliminating and/or minimizing the potential risks to trust species

The Soil Management Plans were also submitted in support of the Section 404 permit application for State Expedited Construction. Both the 404 permit, and the State's 373.1502 permit, specifically reference the FPDA & Aerojet Road Canal's Soil Management Plans. In issuing the 404 Permit, USACE Regulatory Staff, after consultation with USFWS, approved the standard engineering methods described in the FPDA Soil Management Plan, and Special Condition #6 of the permit requires the SFWMD to adhere to the FPDA Soil Management Plan, which is incorporated by reference.

Additional information regarding the HTRW investigations and site soil management plan are included in ***APPENDIX A***.

TABLE B-2: RANGE OF CONCENTRATIONS MEASURED VS. REGULATORY REQUIREMENTS

			EPA Regulatory Levels - USEPA Region 9 RSLs		State Regulatory Levels		State Guidance	
Parameter / CAS# s [1]	**CERCLA [2] Regulated (Y/N)**	**Range [3] Observed [mg/Kg]**	**Residential [5] [mg/Kg]**	**Industrial [6] [mg/Kg]**	**Residential [7] Direct Exposure [mg/Kg]**	**Commercial [8] / Industrial Direct Exposure [mg/Kg]**	**SQAG TEC [9] [mg/Kg]**	**SQAG PEC [10] [mg/Kg]**
Arsenic / 7784-42-1	Y	1.9 -7.3	**2.1**	12	**2.1**	12	9.8	33
Barium / 7440-39-3	N	12 - 130	15,000	190,000	120**	130,000	**20**	60
Cadmium / 7440-43-9	Y	0.18 - 1.4	70	800	82	1,700	**1**	5
Chromium (total) / 7440-47-3	Y	20 - 100	N/A	N/A	210	470	43	110
Lead / 7439-92-1	Y	3.3 - 52	400	800	400	1,400	36	130
Copper / 7440-50-8	Y	20 - 320	3,100	41,000	**150****	89,000	**32**	**85*****
Zinc / 7440-666	Y	27 - 250	23,000	310,000	26,000	630,000	**121**	459
Total Chlordane / (j)	Y	0.00043 - 0.0072	1.6	6.5	2.8	14	3.24	17.6
Endosulfan / 115-29-7	Y	0.00026 - 0.2607	320	3,700	450	7,600	NA	NA
4,4-DDT / 50-29-3	Y	0.00066 - 0.011	1.7	7	2.9	15	4.16	62.9
4,4-DDE / 72-55-9	Y	0.00062 - 0.059	1.4	5.1	2.9	15	3.16	31.3

Notes:
mg/Kg – milligrams per Kilogram
mg/L – milligrams per Liter
[1] CAS Registry Number (CAS#s) - unique numeric identifier which designates one substance and has no chemical significance
[2] 40 Code of Federal Regulations (CFR) 302.4, Designation of Hazardous Substances - Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
[3] Range of chemical concentrations observed in all the samples collected within the Frog Pond Project Area
[4] USEPA Regional Screening Level (RSL) Table – Industrial
[5] United States Environmental Protection Agency (USEPA) Region 9 Preliminary Remediation Goals (PRGs) - Regional Screening Level (RSL) Table – Residential
[6] USEPA Region 9 PRGs - RSL Table – Industrial
[7] Chapter 62-777, Florida Administrative Code (FAC), Table 2 - Technical Background Document, Soil Cleanup Target Levels (SCTLs), Direct Exposure – Residential
[8] Chapter 62-777, FAC, Table 2 - Technical Background Document, SCTLs, Direct Exposure - Commercial / Industrial
[9] Table 4-4, Threshold Effect Concentrations (TECs; i.e., below which harmful effects are unlikely to be observed), From: Development and Evaluation of Numerical Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters, Report prepared by Macdonald Environmental for FDEP, 2003.
[10] Table 4-4, Probable Effect Concentrations (PECs; i.e., above which harmful effects are likely to be observed), From: Development and Evaluation of Numerical Sediment Quality Assessment Guidelines (SQAGs) for Florida Inland Waters, Report prepared by Macdonald Environmental for FDEP, 2003.
(j) - 12789-03-6 or 57-74-9
** - Direct Exposure value based on acute toxicity considerations. This criterion is applicable in scenarios where children might be exposed to soils (e.g. residences, schools, playgrounds)
N/A - Not Available
*** - U. S. Fish and Wildlife Service Interim Screening Value

B.2.2.4 **Aquatic Ecosystem and Organism Determinations**

B.2.2.4.1 Effects on Plankton

No adverse impacts to plankton are anticipated. Concentration of freshwater diatoms should increase at a minimum in a narrow zone associated with water deliveries into Taylor Slough.

B.2.2.4.2 Effects on Benthos

No adverse impacts to benthic organisms are anticipated other than displacement of those organisms in the construction footprint of the project.

B.2.2.4.3 Effects on Nekton

There should be no adverse impacts to freshwater swimming aquatic organisms including fishes during construction. Additionally, no adverse impacts are expected downstream in the waters of Florida Bay and the adjacent coastline. Estuarine fish species most likely to occur in these areas include the small forage species such as killifish (*Cyprinodon* spp. and *Fundulus* spp.), mosquito fish (*Gambusia affinish*), juvenile sciaenids (*Leiostomus* spp.), silversides (*Atherinidae*) and mullets (*Mugil* spp.). Larger secondary consumers include gray snapper (*Lutjanus griesus*), tarpon (*Megalops atlantica*), snook

(*Centopomus* spp.), red drum (*Sciaenops ocellatus*) and spotted seatrout (*Cynoscion nebulosus*). Freshwater deliveries through Taylor Slough would provide improved habitat and nursery opportunities for fishes in downstream estuaries connecting coastal wetlands to the bay.

B.2.2.4.4 Effects on the Aquatic Food Web

No adverse impacts on the aquatic food web are anticipated other than minor temporary impacts within the construction footprint of the proposed spreader channels. Periphyton forms the base of the food web within the project area. Implementation of the project is expected to increase periphyton mat biomass and productivity throughout the site as well as freshwater diatoms.

B.2.2.5 **Effects on Special Aquatic Sites:**

B.2.2.5.1 Hardground and Coral Reef Communities

There are no hardground or coral reef communities located within the proposed project site or the nearshore waters affected by the project. Corals found within the waters of Florida Bay are outside of the area of potential effect.

B.2.2.5.2 Sanctuaries and Refuges

The project area is adjacent to ENP and is intended to improve the quantity timing and distribution of water delivered to Florida Bay via Taylor Slough. Taylor Slough is located within ENP, and is one of the park's two main drainage systems.

B.2.2.5.3 Wetlands

The dominant vegetation community in the region is a matrix of sawgrass prairie with tree islands. At the lowest elevations near the coast mangroves replace the freshwater wetlands. The transition zone between the mangroves and the freshwater prairie is a needle rush-salt grass zone on the freshwater side, but stunted scrub mangrove on the coastal side. As a result of the project approximately 103.9 acres of wetlands would be removed by construction and excavation activities. This loss is considered minimal and is not anticipated to have any adverse effects. The proposed project is anticipated to provide positive ecological benefits, including improving hydroperiods and hydropatterns in the Southern Glades and Model Lands, improving the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough, and reducing ecologically damaging flows to Florida Bay and other receiving waters.

B.2.2.5.4 Mud Flats

There are no mud flats within the construction footprint or areas impacted by the project.

B.2.2.5.5 Vegetated Shallows

Submerged aquatic vegetation (SAV) is present throughout the nearshore waters. The trend shows the following species in order from the shoreline to the deeper waters: widgeon grass (Ruppia maritime), shoal grass, turtle grass. Without operational changes and/or active pumping the project is not anticipated to have any effect on SAV.

B.2.2.5.6 Riffle and Pool Complexes

There are none within the project footprint and none should be impacted by the project.

B.2.2.5.7 Threatened and Endangered Species

There are 20 federally listed threatened and endangered (T&E) species potentially present in the project area. That number includes the American alligator which is categorized as a species of similar appearance to the American crocodile. With the exception of the Cape Sable seaside sparrow (CSSS), the US Army Corps of Engineers (USACE) and US Fish and Wildlife Service (FWS) have consulted on a determination of no effect or may affect not likely to adversely affect decision for all federally listed species and designated critical habitat within the project area. For the CSSS, implementation of the proposed project may affect, and is likely to adversely affect the sub-species and Sub-population D of designated critical habitat. Discussions with FWS on appropriate conservation measures to minimize potential impacts have been conducted and are contained in the Biological Opinion (Annex A).

B.2.2.6 **Proposed Disposal Site Determinations**

B.2.2.6.1 Mixing Zone Determination

The dredged material would not cause unacceptable changes in the mixing zone water quality requirements as specified by the State of Florida's Water Quality Certification (WQC) permit procedures. No adverse impacts related to depth, current velocity, direction and variability, degree of turbulence, stratification, or ambient concentrations of constituents are expected from implementation of the project.

B.2.2.6.2 Determination of Compliance with Applicable Water Quality Standards

The project would comply with federal and state water quality standards.

B.2.2.7 **Potential Effects on Human Use Characteristics:**

B.2.2.7.1 Municipal and Private Water Supply

No municipal or private water supplies would be adversely impacted by the implementation of the project.

B.2.2.7.2 Recreational and Commercial Fisheries

Florida Bay provides critical nursery habitats and food web links for many important commercial and recreational fishery species including bonefish, snook, tarpon, permit, pink shrimp, spotted seatrout, clams, blue crabs and stone crabs, baitfishes, and numerous coral reef fishes that include snappers, groupers, grunts, barracuda, spadefish, spiny lobster, parrotfish and triggerfish. Recreational and commercial fishers would not be adversely affected by the implementation of the project. The project may provide a positive benefit by recreating connection of remnant tidal creeks to the bay and thereby providing habitat i.e., foraging and nursery opportunities for recreational and commercial fish.

B.2.2.7.3 Water Related Recreation

Presently, ENP and Florida Keys National Marine Sanctuary (FKNMS) provide opportunities for fishing, kayaking/canoeing, motorized boating (in areas of adequate water depth) and wildlife viewing. Water related recreation would not be affected as a result of project implementation.

B.2.2.7.4 Aesthetics

The existing environmental setting would not be changed. Some exotic plant control may enhance the aesthetics of the area.

B.2.2.7.5 Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

See Paragraphs ("Sanctuaries and Refuges") above.

B.2.2.8 **Essential Fish Habitat Assessment**

B.2.2.8.1 Project Description:

The goals of the C-111 SC Western project are to improve the quantity, timing, and distribution of water delivered to Eastern Florida Bay via Taylor Slough, improve hydroperiods and hydropatterns in the Southern Glades and Model Lands, and reduce ecologically damaging flows to Florida Bay and other receiving waters. It is anticipated that these improvements will be realized through the establishment of a hydraulic ridge between Taylor Slough and C-111, which will reduce seepage from Taylor Slough and its headwaters. The plan is also anticipated to resolve critical project uncertainties related to the ability to reduce seepage losses from Taylor Slough, and resulting flood control responses of the drainage system. Consistent with the National Research Council's principals of Incremental Adaptive Restoration (IAR), information gained from this initial restoration effort will provide valuable information related to the planning of a subsequent phase of the C-111 SC project which involves construction of a spreader canal system to replace the existing C-111 Canal.

The seepage reducing hydraulic ridge will be established by diverting water that is currently being discharged through S-177, S-18C and S-197 into two separate linear infiltration basins to be constructed within SFWMD owned lands. Further reductions will be realized by constructing an intermediate water control structure on the lower C-111 Canal, and/or through operational changes at structure S-18C. Earthen plugs will be constructed in L-31E and C-110 in order to maximize water levels in and around the canals. A network of override stage triggers will be established in order to meet project constraints such as flood-damage reduction, and ESA compliance.

B.2.2.8.2 Essential Fish Habitat in the Area

The project area contains essential fish habitat for corals, coral reef and live bottom habitat, red drum (*Sciaenops ocellatus*), penaeid shrimp, spiny lobster (*Panulirus argus*), other coastal migratory pelagic species and the snapper-grouper complex. Other species generally present in the Florida region include the stone crab, and the gulf stone crab. Essential fish habitat (EFH) in Florida Bay is comprised of seagrasses, estuarine mangroves, intertidal flats, the estuarine water column, live/hard bottoms, and coral reefs.

B.2.2.8.2.1 Assessments of Effects on Essential Fish Habitat:

Project construction activities should have no effect on the nearshore communities or essential fish habitat downstream of the project area. However, this project is expected to have a beneficial indirect effect by increasing overland flow into Florida Bay through Taylor Slough. The increased flow is anticipated to stabilize the water quality and salinities required to improve and sustain nearshore biological communities.

Seagrasses are expected to benefit from the re-direction and dispersion of fresh water across the wetland systems prior to entering Florida Bay. Seagrass habitats are heavily utilized by both juvenile and adult fishes and invertebrates for feeding and shelter (SAFM 1998). Species that depend on seagrass habitats include the penaeid pink and brown shrimp, and spiny lobster (SAFM, 1998).

Seagrass performs as an important nursery habitat for red drum, snook (*Centropomus* spp.), bonefish (*Albula vulpes*), tarpon (*Megalops atlanticus*) and several species of snapper and grouper, and is critical to the health of Florida Bay and a number of commercial and recreational fisheries (SAFM, 1998).

The restored hydrology provided by this project would also increase the periodic inundation of the downstream mangrove wetlands. Mangrove wetlands depend on this periodic inundation; the lack of freshwater from upstream sources contributes to their degradation (SAFM, 1998). Mangrove habitats are important because they provide food and refuge to a large variety of species. These species include: spiny lobsters, pink shrimp, snook (*Centropomus undecimalis*), goliath grouper (*Epinephelus itajara*), tripletail (*Lobotes surinamensis*), leatherjack (*Oligoplites saurus*), gray snapper (*Lutjanus griseus*), dog snapper (*L. jocu*), sailor's choice (*Haemulon parra*), bluestriped grunt (*H. sciurus*), sheepshead (*Archosargus probatocephalus*), black drum (*Pogonias cromis*) and red drum (SAFM, 1998).

The estuarine water column is typically characterized by four salinity categories: oligohaline (< 8 parts per thousand [ppt]), mesohaline (8-18 ppt), and polyhaline waters (18-30 ppt) with some euhaline water (>30 ppt) around inlets (SAFM, 1998). Saline boundaries in the estuarine water column are variable, but are generally maintained by sea water transported through inlets by tide and wind mixing with fresh water supplied by land runoff' (SAFM, 1998). This project will improve quantity, timing, and distribution of water delivered to eastern Florida Bay. It is likely that this will result in an improvement to the salinity characteristics of the estuarine water column. This habitat is utilized by larvae of commercially important fishes for feeding, and is an important means of conveying organisms and nutrients from inland to offshore areas (SAFM, 1998).

This project is not expected to have an effect on coral reef or hard bottom communities. There are no coral reefs or hard bottom communities located within the proposed project site or the nearshore waters affected by the project. Corals found within Florida Bay are outside the area of potential effect.

B.2.2.8.3 Conclusion

Current operations in the project area have resulted in an inland migration of saline conditions in both groundwater and surface waters. This has caused the expansion of moderate to high salinity zones and has diminished the spatial extent of freshwater wetland habitats in the project area. Landward expansion of saltwater and mangrove wetlands, including low-productivity, sparsely vegetated dwarf mangrove communities typical of the hypersaline 'white zone' has also occurred in the project area.

The proposed project components would improve freshwater delivery to coastal wetlands and adjacent estuaries. Construction of the project would re-distribute flow to salt water wetlands and nearshore bay areas and result in favorable changes to salinity levels. These changes may affect essential fish habitat, although the impacts to the aquatic resources are anticipated to be beneficial.

B.2.2.8.4 References

South Atlantic Fisheries Management Council (SAFM). 1998. Final Essential Habitat Plan. Charleston, South Carolina

B.2.2.9 Determination of Cumulative Effects on the Aquatic Ecosystem

The overall benefit to the regional system is expected to be far greater than the localized adverse effects. The restoration of hydrology of the greater Everglades ecosystem and the increase in spatial extent of protected wetland acreage in the region would produce extensive cumulative beneficial effects. These beneficial effects are expected to substantially outweigh the cumulative adverse effects produced by the aquatic ecosystem alterations that may be necessary to construct some of the project components.

B.2.2.10 Determination of Secondary Effects on the Aquatic Ecosystem

There would be no adverse secondary impacts on the aquatic ecosystem as a result of the construction. During construction the sites would be contained with sedimentation barriers. Erosion would be controlled by appropriate erosion control techniques. Sedimentation would be controlled during construction. An ecological and water quality monitoring plan would be implemented during and after construction and specific environmental commitments, engineering and design commitments, and operational commitments would be incorporated to avoid, minimize, and/or mitigate for adverse effects.

B.2.3 Findings of Compliance or Non-Compliance with the Restrictions on Discharge

a. No significant adaptations of the guidelines were made relative to this evaluation.
b. At this time, no practicable alternative exists which meets the study objectives that does not involve discharge of fill into waters of the United States.
c. At this time, no practicable alternatives exists which would have less adverse impact on the aquatic ecosystem which does not also have other significant adverse environmental consequences.
d. The discharge of fill materials is not anticipated to cause or contribute to violations of any applicable state water quality standards for Class III

waters. The discharge operation is not anticipated to violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

e. The placement of fill materials in the project area is not anticipated to jeopardize the continued existence of any species listed as T&E or result in the likelihood of destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973, as amended.
f. The placement of fill material is not anticipated to result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife and special aquatic sites. The life stages of aquatic species and other wildlife is not anticipated to be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values are not anticipated.
g. Based on the guidelines, the proposed discharge site for the discharge of fill and/or dredged material is specified as complying with the requirements of these guidelines.

B.3 COASTAL ZONE CONSISTENCY EVALUATION

B.3.1 FLORIDA COASTAL ZONE MANAGEMENT PROGRAM FEDERAL CONSISTENCY EVALUATION PROCEDURES

B.3.1.1 Chapter 161, Beach and Shore Preservation

The intent of the coastal construction permit program established by this chapter is to regulate construction projects located seaward of the line of mean high water and which might have an effect on natural shoreline processes.

Response: The proposed plans and information will be submitted to the state in compliance with this chapter. No work is proposed seaward of the mean high water line in beach areas.

B.3.1.2 Chapters 186 and 187, State and Regional Planning

These chapters establish the State Comprehensive Plan that sets goals that articulate a strategic vision of the State's future. Its purpose is to define in a broad sense, goals and policies that provide decision-makers directions for the future and provide long-range guidance for an orderly social, economic and physical growth.

Response: The proposed project has been coordinated with various federal, state and local agencies during the planning process. The proposed project would achieve the goals of this chapter by contributing to a long-range master plan for south Florida's water resources, which would support the continued orderly social, economic and physical growth of the region.

B.3.1.3 Chapter 252, Disaster Preparation, Response and Mitigation

This chapter creates a state emergency management agency, with the authority to provide for the common defense; to protect the public peace, health and safety; and to preserve the lives and property of the people of Florida.

Response: This statute is not applicable to this project.

B.3.1.4 Chapter 253, State Lands

This chapter governs the management of submerged state lands and resources within state lands. This includes archeological and historical resources; water resources; fish and wildlife resources; near shore reefs; beaches and dunes; submerged grass beds and other benthic communities; swamps, marshes and other wetlands; mineral resources; unique natural features; submerged lands; spoil islands; and artificial reefs.

Response: The proposed project would make a positive contribution to preserving cultural, water, fish and wildlife, wetland and estuarine resources. The proposed project would comply with the intent of this chapter.

B.3.1.5 **Chapters 253, 259, 260, and 375, Land Acquisition**

This chapter authorizes the state to acquire land to protect environmentally sensitive areas.

Response: Much of the property proposed for this project is already in public ownership. The proposed project would comply with the intent of this chapter.

B.3.1.6 **Chapter 258, State Parks and Aquatic Preserves**

This chapter authorizes the state to manage state parks and preserves. Consistency with this statute would include consideration of projects that would directly or indirectly adversely impact park property, natural resources, park programs, management or operations.

Response: The ENP and the Florida Bay National Marine Sanctuary are within the project area and contain productive estuarine and wetland ecosystems that include aquatic preserves along with local parks and recreation areas. The aquatic preserves are also outstanding Florida water bodies. The proposed project would improve the timing and delivery of water to Florida Bay which will have a positive effect on these areas. The proposed project would comply with the intent of this chapter.

B.3.1.7 **Chapter 267, Historic Preservation**

This chapter establishes the procedures for implementing the Florida Historic Resources Act responsibilities and for implementing the Section 106 of the National Historic Preservation Act of 1966, as amended; and the National Environmental Policy Act of 1969, as amended.

Response: Cultural resource surveys have been completed for the C-111 SC Western project. A literature review has determined that the study area had a low potential for undetected cultural resources. Additionally, pre-field research by the USACE did not identify any sites within the project's area of potential effect. As a result, the USACE has determined that the project will not affect historic properties eligible for listing on the National Register of Historic Places. The Florida State Historic Preservation Officer concurred with this determination (Florida State Department of Historic Preservation numbers 2004-8676 and 2006-07757). The project will be consistent with the goals of this chapter.

B.3.1.8 Chapter 288, Economic Development and Tourism

This chapter directs the state to provide guidance and promotion of beneficial development through encouraging economic diversification and promoting tourism.

Response: The proposed project would achieve the goals of this chapter by contributing to a long-range master plan for south Florida's water resources, which would support economic diversification and tourism.

B.3.1.9 Chapters 334 (Transportation Administration), 335 (State Highway System), 338 (Intrastate Highway System and Toll Facilities) and 339 (Public Transportation)

These chapters authorize the planning and development of a safe, balanced and efficient transportation system.

Response: No public transportation systems would be impacted by this project.

B.3.1.10 Chapter 370, Saltwater Living Resources

This chapter directs the State to preserve, manage and protect the marine, crustacean, shell and anadromous fishery resources in state waters; to protect and enhance the marine and estuarine environment; to regulate fishermen and vessels of the State engaged in the taking of such resources within or without state waters; to issue licenses for the taking and processing products of fisheries; to secure and maintain statistical records of the catch of each such species; and to conduct scientific, economic, and other studies and research.

Response: The proposed project is consistent with the goals of this chapter. Implementation of the project will provide direct positive impacts on saltwater resources within Florida Bay and adjacent estuaries by distributing freshwater flows through Taylor Slough to provide a more natural and historic overland flow through existing coastal wetlands that will reduce hyper-saline conditions and improve the overall salinity balance. This will benefit seagrass, fisheries, and wildlife.

B.3.1.11 Chapter 372, Living Land and Freshwater Resources

This chapter establishes the Game and Freshwater Fish Commission (now called the Florida Fish and Wildlife Conservation Commission [FWC]) and directs it to manage freshwater aquatic life and wild animal life and their habitat to perpetuate a diversity of species with densities and distributions that provide sustained ecological, recreational, scientific, educational, aesthetic, and economic benefits.

Response: The project will have a long-term beneficial effect on freshwater aquatic life and wild animal life by distributing freshwater flows through Taylor Slough to provide a more natural and historic overland flow within the freshwater wetlands adjacent to Florida Bay. The proposed project is consistent with the intent of this chapter.

B.3.1.12 **Chapter 373, Water Resources**

This chapter provides the authority to regulate the withdrawal, diversion, storage, and consumption of water.

Response: The non-federal sponsor for this project is the SFWMD, which is the state agency responsible for implementing this statute. Coordinated planning has been done with this agency to ensure compatibility with established policies. The project is consistent with the goals of this chapter.

B.3.1.13 **Chapter 376, Pollutant Spill Prevention and Control**

This chapter regulates the transfer, storage, and transportation of pollutants and the cleanup of pollutant discharges.

Response: The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will require that the contractor adopt safe and sanitary measures for the disposal of solid wastes. A spill prevention plan will be required.

B.3.1.14 **Chapter 377, Oil and Gas Exploration and Production**

This chapter authorizes the regulation of all phases of exploration, drilling, and production of oil, gas, and other petroleum products.

Response: This project does not involve the exploration, drilling, or production of gas, oil or petroleum product and therefore, this chapter does not apply.

B.3.1.15 **Chapter 380, Environmental Land and Water Management**

This chapter establishes criteria and procedures to assure that local land development decisions consider the regional impact of proposed large-scale development on natural systems.

Response: The proposed project incorporates restoration components primarily intended to benefit freshwater wetlands and estuarine resources by distributing freshwater flows through Taylor Slough to Florida Bay. This includes the installation/construction of pump stations, flow-ways, berms and canal plugs. This also includes minimizing the number and severity of events of point source canal water discharges where harmful amounts of freshwater are discharged into the nearshore marine communities. These primary project functions help to moderate unnatural changes in salinity which is extremely detrimental to estuarine communities. The project is consistent with the intent of this chapter.

B.3.1.16 **Chapter 388, Arthropod Control**

This chapter provides for a comprehensive approach for abatement or suppression of mosquitoes and other pest arthropods within the state.

Response: The project would not further the propagation of mosquitoes or other pest arthropods.

B.3.1.17 **Chapter 403, Environmental Control**

This chapter authorizes the regulation of pollution of the air and waters of the state by the Florida Department of Environmental Regulation (now a part of the Florida Department of Environmental Protection [FDEP]).

Response: An Environmental Impact Statement (EIS) addressing project impacts has been prepared and will be reviewed by the appropriate resource agencies including the FDEP. Environmental protection measures will be implemented to ensure that no lasting adverse effects on water quality, air quality, or other environmental resources will occur. WQC will be sought from the State prior to construction. The project complies with the intent of this chapter.

B.3.1.18 **Chapter 582, Soil and Water Conservation**

This chapter establishes policy for the conservation of state soil and water through the Department of Agriculture. Land use policies will be evaluated in terms of their tendency to cause or contribute to soil erosion or to conserve, develop, and utilize soil and water resources both onsite or in adjoining properties affected by the project. Particular attention will be given to projects on or near agricultural lands.

Response: Project construction and implementation will include appropriate erosion control plans and measures to ensure compliance with the intent of the chapter.

B.4 Pertinent Correspondence / Compliance Letters

B.4.1 NRCS Correspondence

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning Division
Environmental Branch

NOV 0 6 2008

Mr. Rick Robbins
Natural Resources Conservation Service
Soils Section
2614 NW 43rd Street
Gainesville, Florida 32606-6611

Dear Mr. Robbins:

The U.S. Army Corps of Engineers (Corps), Jacksonville District, is submitting the Farmland Conversion Impact Rating (Form AD-1006) for Phase I of the C-111 Spreader Canal project. In order to initiate consultation and ensure compliance under the Farmland Protection Policy Act, the Corps is requesting an evaluation from the Natural Resources Conservation Service on farmland impacts within the proposed project area.

Enclosed is the Farmland Conversion Impact Rating (Form AD-1006) with Parts I and III completed by the Corps, and a study map including all project features. We are asking your agency to provide information on the remaining portion of the form. The project will directly convert approximately 600 acres of land that is currently being used to grow row crops. This conversion will take place in the Frog Pond area (see enclosed map), with the construction of a water detention feature. The Frog Pond is leased to farming entities by the South Florida Water Management District. The leases on the property that is currently being used to farm row crops will expire on June 30, 2009. It is expected that all farming activities will cease at this time.

If you have any questions, please contact Mr. Brad Tarr at 904-232-3582 or Bradley.a.tarr@usace.army.mil .

Sincerely,

Rebecca S. Griffith

Rebecca S. Griffith, Ph.D., PMP
Chief, Planning Division

Enclosure

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 11/7/08
Name Of Project Phase I, C-111 Spreader Canal Project	Federal Agency Involved U.S. Army Corps of Engineers
Proposed Land Use restoration	County And State Miami-Dade County, Florida
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	Yes ☐ No ☐	Acres Irrigated	Average Farm Size
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %	Amount Of Farmland As Defined in FPPA Acres: %	
Name Of Land Evaluation System Used	Name Of Local Site Assessment System	Date Land Evaluation Returned By NRCS	

PART III *(To be completed by Federal Agency)*	Maximum Points	Alternative Site Rating Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		600.0			
B. Total Acres To Be Converted Indirectly		0.0			
C. Total Acres In Site		600.0	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland					
B. Total Acres Statewide And Local Important Farmland					
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted					
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value					
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*		0	0	0	0
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use					
2. Perimeter In Nonurban Use					
3. Percent Of Site Being Farmed					
4. Protection Provided By State And Local Government					
5. Distance From Urban Builtup Area					
6. Distance To Urban Support Services					
7. Size Of Present Farm Unit Compared To Average					
8. Creation Of Nonfarmable Farmland					
9. Availability Of Farm Support Services					
10. On-Farm Investments					
11. Effects Of Conversion On Farm Support Services					
12. Compatibility With Existing Agricultural Use					
TOTAL SITE ASSESSMENT POINTS	160	0	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	0	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	0	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	0	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side)
This form was electronically produced by National Production Services Staff

Clear Form

Form AD-1006 (10-83)

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 – Federal agencies involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form.

Step 2 – Originator will send copies A, B and C together with maps indicating locations of site(s), to the Natural Resources Conservation Service (NRCS) local field office and retain copy D for their files. (Note: NRCS has a field office in most counties in the U.S. The field office is usually located in the county seat. A list of field office locations are available from the NRCS State Conservationist in each state).

Step 3 – NRCS will, within 45 calendar days after receipt of form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland.

Step '4 – In cases where farmland covered by the FPPA will be converted by the proposed project, NRCS field offices will complete Parts II, IV and V of the form.

Step 5 – NRCS will return copy A and B of the form to the Federal agency involved in the project. (Copy C will be retained for NRCS records).

Step 6 – The Federal agency involved in the proposed project will complete Parts VI and VII of the form.

Step 7 – The Federal agency involved in the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA and the agency's internal policies.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

Part I: In completing the "County And State" questions list all the local governments that are responsible for local land controls where site(s) are to be evaluated.

Part III: In completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them.

2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities) that will cause a direct conversion.

Part VI: Do not complete Part VI if a local site assessment is used.

Assign the maximum points for each site assessment criterion as shown in § 658.5 (b) of CFR. In cases of corridor-type projects such as transportation, powerline and flood control, criteria #5 and #6 will not apply and will, be weighed zero, however, criterion #8 will be weighed a maximum of 25 points, and criterion #11 a maximum of 25 points.

Individual Federal agencies at the national level, may assign relative weights among the 12 site assessment criteria other than those shown in the FPPA rule. In all cases where other weights are assigned relative adjustments must be made to maintain the maximum total weight points at 160.

In rating alternative sites, Federal agencies shall consider each of the criteria and assign points within the limits established in the FPPA rule. Sites most suitable for protection under these criteria will receive the highest total scores, and sites least suitable, the lowest scores.

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, adjust the site assessment points to a base of 160. Example: if the Site Assessment maximum is 200 points, and alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site "A."}$$

Site Assessment Scoring for the Twelve Factors Used in FPPA

The Site Assessment criteria used in the Farmland Protection Policy Act (FPPA) rule are designed to assess important factors other than the agricultural value of the land when determining which alternative sites should receive the highest level of protection from conversion to non agricultural uses.

Twelve factors are used for Site Assessment and ten factors for corridor-type sites. Each factor is listed in an outline form, without detailed definitions or guidelines to follow in the rating process. The purpose of this document is to expand the definitions of use of each of the twelve Site Assessment factors so that all persons can have a clear understanding as to what each factor is intended to evaluate and how points are assigned for given conditions.

In each of the 12 factors a number rating system is used to determine which sites deserve the most protection from conversion to non-farm uses. The higher the number value given to a proposed site, the more protection it will receive. The maximum scores are 10, 15 and 20 points, depending upon the relative importance of each particular question. If a question significantly relates to why a parcel of land should not be converted, the question has a maximum possible protection value of 20, whereas a question which does not have such a significant impact upon whether a site would be converted, would have fewer maximum points possible, for example 10.

The following guidelines should be used in rating the twelve Site Assessment criteria:

1. How much land is in non-urban use within a radius of 1.0 mile from where the project is intended?

More than 90 percent:	15 points
90-20 percent:	14 to 1 points
Less than 20 percent:	0 points

This factor is designed to evaluate the extent to which the area within one mile of the proposed site is non-urban area. For purposes of this rule, "non-urban" should include:

- Agricultural land (crop-fruit trees, nuts, oilseed)
- Range land
- Forest land
- Golf Courses
- Non paved parks and recreational areas
- Mining sites
- Farm Storage
- Lakes, ponds and other water bodies
- Rural roads, and through roads without houses or buildings
- Open space
- Wetlands
- Fish production
- Pasture or hayland

Urban uses include:

- Houses (other than farm houses)
- Apartment buildings
- Commercial buildings
- Industrial buildings
- Paved recreational areas (i.e. tennis courts)
- Streets in areas with 30 structures per 40 acres
- Gas stations

- Equipment, supply stores
- Off-farm storage
- Processing plants
- Shopping malls
- Utilities/Services
- Medical buildings

In rating this factor, an area one-mile from the outer edge of the proposed site should be outlined on a current photo; the areas that are urban should be outlined. For rural houses and other buildings with unknown sizes, use 1 and 1/3 acres per structure. For roads with houses on only one side, use one half of road for urban and one half for non-urban.

The purpose of this rating process is to insure that the most valuable and viable farmlands are protected from development projects sponsored by the Federal Government. With this goal in mind, factor S1 suggests that the more agricultural lands surrounding the parcel boundary in question, the more protection from development this site should receive. Accordingly, a site with a large quantity of non-urban land surrounding it will receive a greater
number of points for protection from development. Thus, where more than 90 percent of the area around the proposed site (do not include the proposed site in this assessment) is non-urban, assign 15 points. Where 20 percent or less is
non-urban, assign 0 points. Where the area lies between 20 and 90 percent non-urban, assign appropriate points from 14 to 1, as noted below.

Percent Non-Urban Land within 1 mile	**Points**
90 percent or greater	15
85 to 89 percent	14
80 to 84 percent	13
75 to 79 percent	12
70 to 74 percent	11
65 to 69 percent	10
60 to 64 percent	9
55 to 59 percent	8
50 to 54 percent	7
45 to 49 percent	6
40 to 44 percent	5
35 to 39 percent	4
30 to 24 percent	3
25 to 29 percent	2
21 to 24 percent	1
20 percent or less	0

2. How much of the perimeter of the site borders on land in non-urban use?

More than 90 percent:	l0 points
90 to 20 percent:	9 to 1 point(s)
Less than 20 percent:	0 points

This factor is designed to evaluate the extent to which the land adjacent to the proposed site is non-urban use. Where factor #1 evaluates the general location of the proposed site, this factor evaluates the immediate perimeter of the site. The definition of urban and non-urban uses in factor #1 should be used for this factor.

In rating the second factor, measure the perimeter of the site that is in non-urban and urban use. Where more than 90 percent of the perimeter is in non-urban use, score this factor 10 points. Where less than 20 percent, assign 0 points. If a road is next to the perimeter, class the area according to the use on the other side of the road for that area. Use 1 and 1/3 acre per structure if not otherwise known. Where 20 to 90 percent of the perimeter is non-urban, assign points as noted below:

Percentage of Perimeter Bordering Land	Points
90 percent or greater	10
82 to 89 percent	9
74 to 81 percent	8
65 to 73 percent	7
58 to 65 percent	6
50 to 57 percent	5
42 to 49 percent	4
34 to 41 percent	3
27 to 33 percent	2
21 to 26 percent	1
20 percent or Less	0

3. **How much of the site has been farmed (managed for a scheduled harvest or timber activity) more than five of the last ten years?**

More than 90 percent:	20 points
90 to 20 percent:	19 to 1 point(s)
Less than 20 percent:	0 points

This factor is designed to evaluate the extent to which the proposed conversion site has been used or managed for agricultural purposes in the past 10 years.

Land is being farmed when it is used or managed for food or fiber, to include timber products, fruit, nuts, grapes, grain, forage, oil seed, fish and meat, poultry and dairy products.

Land that has been left to grow up to native vegetation without management or harvest will be considered as abandoned and therefore not farmed. The proposed conversion site should be evaluated and rated according to the percent, of the site farmed.

If more than 90 percent of the site has been farmed 5 of the last 10 years score the site as follows:

Percentage of Site Farmed	Points
90 percent or greater	20
86 to 89 percent	19
82 to 85 percent	18
78 to 81 percent	17
74 to 77 percent	16
70 to 73 percent	15
66 to 69 percent	14
62 to 65 percent	13
58 to 61 percent	12
54 to 57 percent	11
50 to 53 percent	10
46 to 49 percent	9
42 to 45 percent	8
38 to 41 percent	7
35 to 37 percent	6
32 to 34 percent	5
29 to 31 percent	4
26 to 28 percent	3

23 to 25 percent	2
20 to 22 percent percent or Less	1
Less than 20 percent	0

4. Is the site subject to state or unit of local government policies or programs to protect farmland or covered by private programs to protect farmland?

Site is protected:	20 points
Site is not protected:	0 points

This factor is designed to evaluate the extent to which state and local government and private programs have made efforts to protect this site from conversion.

State and local policies and programs to protect farmland include:

State Policies and Programs to Protect Farmland

1. Tax Relief:

A. Differential Assessment: Agricultural lands are taxed on their agricultural use value, rather than at market value. As a result, farmers pay fewer taxes on their land, which helps keep them in business, and therefore helps to insure that the farmland will not be converted to nonagricultural uses.

1. Preferential Assessment for Property Tax: Landowners with parcels of land used for agriculture are given the privilege of differential assessment.

2. Deferred Taxation for Property Tax: Landowners are deterred from converting their land to nonfarm uses, because if they do so, they must pay back taxes at market value.

3. Restrictive Agreement for Property Tax: Landowners who want to receive Differential Assessment must agree to keep their land in - eligible use.

B. Income Tax Credits

Circuit Breaker Tax Credits: Authorize an eligible owner of farmland to apply some or all of the property taxes on his or her farmland and farm structures as a tax credit against the owner's state income tax.

C. Estate and Inheritance Tax Benefits

Farm Use Valuation for Death Tax: Exemption of state tax liability to eligible farm estates.

2. "Right to farm" laws:

Prohibits local governments from enacting laws which will place restrictions upon normally accepted farming practices, for example, the generation of noise, odor or dust.

3. Agricultural Districting:

Wherein farmers voluntarily organize districts of agricultural land to be legally recognized geographic areas. These farmers receive benefits, such as protection from annexation, in exchange for keeping land within the district for a given number of years.

4. Land Use Controls: Agricultural Zoning.

Types of Agricultural Zoning Ordinances include:

A. Exclusive: In which the agricultural zone is restricted to only farm-related dwellings, with, for example, a minimum of 40 acres per dwelling unit.

B. Non-Exclusive: In which non-farm dwellings are allowed, but the density remains low, such as 20 acres per dwelling unit.

Additional Zoning techniques include:

A. Sliding Scale: This method looks at zoning according to the total size of the parcel owned. For example, the number of dwelling units per a given number of acres may change from county to county according to the existing land acreage to dwelling unit ratio of surrounding parcels of land within the specific area.

B. Point System or Numerical Approach: Approaches land use permits on a case by case basis.

LESA: The LESA system (Land Evaluation-Site Assessment) is used as a tool to help assess options for land use on an evaluation of productivity weighed against commitment to urban development.

C. Conditional Use: Based upon the evaluation on a case by case basis by the Board of Zoning Adjustment. Also may include the method of using special land use permits.

5. Development Rights:

A. Purchase of Development Rights (PDR): Where development rights are purchased by Government action.

Buffer Zoning Districts: Buffer Zoning Districts are an example of land purchased by Government action. This land is included in zoning ordinances in order to preserve and protect agricultural lands from non-farm land uses encroaching upon them.

B. Transfer of Development Rights (TDR): Development rights are transferable for use in other locations designated as receiving areas. TDR is considered a locally based action (not state), because it requires a voluntary decision on the part of the individual landowners.

6. Governor's Executive Order: Policy made by the Governor, stating the importance of agriculture, and the preservation of agricultural lands. The Governor orders the state agencies to avoid the unnecessary conversion of important farmland to nonagricultural uses.

7. Voluntary State Programs:

A. California's Program of Restrictive Agreements and Differential Assessments: The California Land Conservation Act of 1965, commonly known as the Williamson Act, allows cities, counties and individual landowners to form agricultural preserves and enter into contracts for 10 or more years to insure that these parcels of land remain strictly for agricultural use. Since 1972 the Act has extended eligibility to recreational and open space lands such as scenic highway corridors, salt ponds and wildlife preserves. These contractually restricted lands may be taxed differentially for their real value. One hundred-acre districts constitute the minimum land size eligible.

Suggestion: An improved version of the Act would state that if the land is converted after the contract expires, the landowner must pay the difference in the taxes between market value for the land and the agricultural tax value which he or she had been paying under the Act. This measure would help to insure that farmland would not be converted after the 10 year period ends.

B. Maryland Agricultural Land Preservation Program: Agricultural landowners within agricultural districts have the opportunity to sell their development rights to the Maryland Land Preservation Foundation under the agreement that these landowners will not subdivide or develop their land for an initial period of five years. After five years the landowner may terminate the agreement with one year notice.

As is stated above under the California Williamson Act, the landowner should pay the back taxes on the property if he or she decides to convert the land after the contract expires, in order to discourage such conversions.

C. Wisconsin Income Tax Incentive Program: The Wisconsin Farmland Preservation Program of December 1977 encourages local jurisdictions in Wisconsin to adopt agricultural preservation plans or exclusive agricultural district zoning ordinances in exchange for credit against state income tax and exemption from special utility assessment. Eligible candidates include local governments and landowners with at least 35 acres of land per dwelling unit in agricultural use and gross farm profits of at least $6.000 per year, or $18,000 over three years.

8. Mandatory State Programs:

A. The Environmental Control Act in the state of Vermont was adopted in 1970 by the Vermont State Legislature. The Act established an environmental board with 9 members (appointed by the Governor) to implement a planning process and a permit system to screen most subdivisions and development proposals according to specific criteria stated in the law. The planning process consists of an interim and a final Land Capability and Development Plan, the latter of which acts as a policy plan to control development. The policies are written in order to:

- prevent air and water pollution;
- protect scenic or natural beauty, historic sites and rare and irreplaceable natural areas; and
- consider the impacts of growth and reduction of development on areas of primary agricultural soils.

B. The California State Coastal Commission: In 1976 the Coastal Act was passed to establish a permanent Coastal Commission with permit and planning authority The purpose of the Coastal Commission was and is to protect the sensitive coastal zone environment and its resources, while accommodating the social and economic needs of the state. The Commission has the power to regulate development in the coastal zones by issuing permits on a case by case basis until local agencies can develop their own coastal plans, which must be certified by the Coastal Commission.

C. Hawaii's Program of State Zoning: In 1961, the Hawaii State Legislature established Act 187, the Land Use Law, to protect the farmland and the welfare of the local people of Hawaii by planning to avoid "unnecessary urbanization". The Law made all state lands into four districts: agricultural, conservation, rural and urban. The Governor appointed members to a State Land Use Commission, whose duties were to uphold the Law and form the boundaries of the four districts. In addition to state zoning, the Land Use Law introduced a program of Differential Assessment, wherein agricultural landowners paid taxes on their land for its agricultural use value, rather than its market value.

D. The Oregon Land Use Act of 1973: This act established the Land Conservation and Development Commission (LCDC) to provide statewide planning goals and guidelines.

Under this Act, Oregon cities and counties are each required to draw up a comprehensive plan, consistent with statewide planning goals. Agricultural land preservation is high on the list of state goals to be followed locally.

If the proposed site is subject to or has used one or more of the above farmland protection programs or policies, score the site 20 points. If none of the above policies or programs apply to this site, score 0 points.

5. How close is the site to an urban built-up area?

The site is 2 miles or more from an urban built-up area	15 points
The site is more than 1 mile but less than 2 miles from an urban built-up area	10 points
The site is less than 1 mile from, but is not adjacent to an urban built-up area	5 points
The site is adjacent to an urban built-up area	0 points

This factor is designed to evaluate the extent to which the proposed site is located next to an existing urban area. The urban built-up area must be 2500 population. The measurement from the built-up area should be made from the point at which the density is 30 structures per 40 acres and with no open or non-urban land existing between the major built-up areas and this point. Suburbs adjacent to cities or urban built-up areas should be considered as part of that urban area.

For greater accuracy, use the following chart to determine how much protection the site should receive according to its distance from an urban area. See chart below:

Distance From Perimeter of Site to Urban Area	Points
More than 10,560 feet	15
9,860 to 10,559 feet	14
9,160 to 9,859 feet	13
8,460 to 9,159 feet	12
7,760 to 8,459 feet	11
7,060 to 7,759 feet	10
6,360 to 7,059 feet	9
5,660 to 6,359 feet	8
4,960 to 5,659 feet	7
4,260 to 4,959 feet	6
3,560 to 4,259 feet	5
2,860 to 3,559 feet	4
2,160 to 2,859 feet	3
1,460 to 2,159 feet	2
760 to 1,459 feet	1
Less than 760 feet (adjacent)	0

6. How close is the site to water lines, sewer lines and/or other local facilities and services whose capacities and design would promote nonagricultural use?

None of the services exist nearer than 3 miles from the site	15 points
Some of the services exist more than one but less than 3 miles from the site	10 points
All of the services exist within 1/2 mile of the site	0 points

This question determines how much infrastructure (water, sewer, etc.) is in place which could facilitate nonagricultural development. The fewer facilities in place, the more difficult it is to develop an area. Thus, if a proposed site is further away from these services (more than 3 miles distance away), the site should be awarded the highest number of points (15). As the distance of the parcel of land to services decreases, the number of points awarded declines as well. So, when the site is equal to or further than 1 mile but less than 3 miles away from services, it should be given 10 points. Accordingly, if this distance is 1/2 mile to less than 1 mile, award 5 points; and if the distance from land to services is less than 1/2 mile, award 0 points.

Distance to public facilities should be measured from the perimeter of the parcel in question to the nearest site(s) where necessary facilities are located. If there is more than one distance (i.e. from site to water and from site to sewer), use the average distance (add all distances and then divide by the number of different distances to get the average).

Facilities which could promote nonagricultural use include:

- Water lines
- Sewer lines
- Power lines
- Gas lines
- Circulation (roads)
- Fire and police protection
- Schools

7. Is the farm unit(s) containing the site (before the project) as large as the average-size farming unit in the county? (Average farm sizes in each county are available from the NRCS field offices in each state. Data are from the latest available Census of Agriculture, Acreage of Farm Units in Operation with $1,000 or more in sales.)

As large or larger:	10 points
Below average: Deduct 1 point for each 5 percent below the average, down to 0 points if 50 percent or more is below average	9 to 0 points

This factor is designed to determine how much protection the site should receive, according to its size in relation to the average size of farming units within the county. The larger the parcel of land, the more agricultural use value the land possesses, and vice versa. Thus, if the farm unit is as large or larger than the county average, it receives the maximum number of points (10). The smaller the parcel of land compared to the county average, the fewer number of points given. Please see below:

Parcel Size in Relation to Average County Size	Points
Same size or larger than average (l00 percent)	10
95 percent of average	9
90 percent of average	8
85 percent of average	7
80 percent of average	6
75 percent of average	5
70 percent of average	4
65 percent of average	3
60 percent of average	2
55 percent of average	1
50 percent or below county average	0

State and local Natural Resources Conservation Service offices will have the average farm size information, provided by the latest available Census of Agriculture data

8. If this site is chosen for the project, how much of the remaining land on the farm will become non-farmable because of interference with land patterns?

Acreage equal to more than 25 percent of acres directly converted by the project	10 points
Acreage equal to between 25 and 5 percent of the acres directly converted by the project	9 to 1 point(s)
Acreage equal to less than 5 percent of the acres directly converted by the project	0 points

This factor tackles the question of how the proposed development will affect the rest of the land on the farm The site which deserves the most protection from conversion will receive the greatest number of points, and vice versa. For example, if the project is small, such as an extension on a house, the rest of the agricultural land would remain farmable, and thus a lower number of points is given to the site. Whereas if a large-scale highway is planned, a greater portion of the land (not including the site) will become non-farmable, since access to the farmland will be blocked; and thus, the site should receive the highest number of points (10) as protection from conversion

Conversion uses of the Site Which Would Make the Rest of the Land Non-Farmable by Interfering with Land Patterns

Conversions which make the rest of the property nonfarmable include any development which blocks accessibility to the rest of the site Examples are highways, railroads, dams or development along the front of a site restricting access to the rest of the property.

The point scoring is as follows:

Amount of Land Not Including the Site Which Will Become Non-Farmable	Points
25 percent or greater	10
23 - 24 percent	9
21 - 22 percent	8
19 - 20 percent	7
17 - 18 percent	6
15 - 16 percent	5
13 - 14 percent	4
11 - 12 percent	3
9 - 11 percent	2
6 - 8 percent	1
5 percent or less	0

9. Does the site have available adequate supply of farm support services and markets, i.e., farm suppliers, equipment dealers, processing and storage facilities and farmer's markets?

All required services are available	5 points
Some required services are available	4 to 1 point(s)
No required services are available	0 points

This factor is used to assess whether there are adequate support facilities, activities and industry to keep the farming business in business. The more support facilities available to the agricultural landowner, the more feasible it is for him or her to stay in production. In addition, agricultural support facilities are compatible with farmland. This fact is important, because some land uses are not compatible; for example, development next to farmland cam be dangerous to the welfare of the agricultural land, as a result of pressure from the neighbors who often do not appreciate the noise, smells and dust intrinsic to farmland. Thus, when all required agricultural support services are available, the maximum number of points (5) are awarded. When some services are available, 4 to 1 point(s) are awarded; and consequently, when no services are available, no points are given. See below:

Percent of Services Available	Points
100 percent	5
75 to 99 percent	4
50 to 74 percent	3
25 to 49 percent	2
1 to 24 percent	1
No services	0

10. Does the site have substantial and well-maintained on farm investments such as barns, other storage buildings, fruit trees and vines, field terraces, drainage, irrigation, waterways, or other soil and water conservation measures?

High amount of on-farm investment	20 points
Moderate amount of non-farm investment	19 to 1 point(s)
No on-farm investments	0 points

This factor assesses the quantity of agricultural facilities in place on the proposed site. If a significant agricultural infrastructure exists, the site should continue to be used for farming, and thus the parcel will receive the highest amount of points towards protection from conversion or development. If there is little on farm investment, the site will receive comparatively less protection. See-below:

Amount of On-farm Investment	Points
As much or more than necessary to maintain production (100 percent)	20
95 to 99 percent	19
90 to 94 percent	18
85 to 89 percent	17
80 to 84 percent	16
75 to 79 percent	15
70 to 74 percent	14
65 to 69 percent	13
60 to 64 percent	12
55 to 59 percent	11
50 to 54 percent	10
45 to 49 percent	9
40 to 44 percent	8
35 to 39 percent	7
30 to 34 percent	6
25 to 29 percent	5
20 to 24 percent	4
15 to 19 percent	3
10 to 14 percent	2
5 to 9 percent	1
0 to 4 percent	0

11. Would the project at this site, by converting farmland to nonagricultural use, reduce the support for farm support services so as to jeopardize the continued existence of these support services and thus, the viability of the farms remaining in the area?

Substantial reduction in demand for support services if the site is converted	10 points
Some reduction in demand for support services if the site is converted	9 to 1 point(s)
No significant reduction in demand for support services if the site is converted	0 points

This factor determines whether there are other agriculturally related activities, businesses or jobs dependent upon the working of the pre-converted site in order for the others to remain in production. The more people and farming activities relying upon this land, the more protection it should receive from conversion. Thus, if a substantial reduction in demand for support services were to occur as a result of conversions, the proposed site would receive a high score of 10; some reduction in demand would receive 9 to 1 point(s), and no significant reduction in demand would receive no points.

Specific points are outlined as follows:

Amount of Reduction in Support Services if Site is Converted to Nonagricultural Use	Points
Substantial reduction (100 percent)	10
90 to 99 percent	9
80 to 89 percent	8
70 to 79 percent	7
60 to 69 percent	6
50 to 59 percent	5
40 to 49 percent	4
30 to 39 percent	3
20 to 29 percent	2
10 to 19 percent	1
No significant reduction (0 to 9 percent)	0

12. Is the kind and intensity of the proposed use of the site sufficiently incompatible with agriculture that it is likely to contribute to the eventual conversion of the surrounding farmland to nonagricultural use?

Proposed project is incompatible with existing agricultural use of surrounding farmland	10 points
Proposed project is tolerable of existing agricultural use of surrounding farmland	9 to 1 point(s)
Proposed project is fully compatible with existing agricultural use of surrounding farmland	0 points

Factor 12 determines whether conversion of the proposed agricultural site will eventually cause the conversion of neighboring farmland as a result of incompatibility of use of the first with the latter. The more incompatible the proposed conversion is with agriculture, the more protection this site receives from conversion. Therefor-, if the proposed conversion is incompatible with agriculture, the site receives 10 points. If the project is tolerable with agriculture, it receives 9 to 1 points; and if the proposed conversion is compatible with agriculture, it receives 0 points.

CORRIDOR - TYPE SITE ASSESSMENT CRITERIA

The following criteria are to be used for projects that have a linear or corridor - type site configuration connecting two distant points, and crossing several different tracts of land. These include utility lines, highways, railroads, stream improvements, and flood control systems. Federal agencies are to assess the suitability of each corridor-type site or design alternative for protection as farmland along with the land evaluation information.

For Water and Waste Programs, corridor analyses are not applicable for distribution or collection networks. Analyses are applicable for transmission or trunk lines where placement of the lines are flexible.

(1) How much land is in nonurban use within a radius of 1.0 mile form where the project is intended?

(2) More than 90 percent	(3) 15 points
(4) 90 to 20 percent	(5) 14 to 1 point(s).
(6) Less than 20 percent	(7) 0 points

(2) How much of the perimeter of the site borders on land in nonurban use?

(3) More than 90 percent	(4) 10 point(s)
(5) 90 to 20 percent	(6) 9 to 1 points
(7) less than 20 percent	(8) 0 points

(3) How much of the site has been farmed (managed for a scheduled harvest or timber activity) more than five of the last 10 years?

(4) More than 90 percent	(5) 20 points
(6) 90 to 20 percent	(7) 19 to 1 point(s)
(8) Less than 20 percent	(9) 0 points

(4) Is the site subject to state or unit of local government policies or programs to protect farmland or covered by private programs to protect farmland?

Site is protected	20 points
Site is not protected	0 points

(5) Is the farm unit(s) containing the site (before the project) as large as the average - size farming unit in the County? (Average farm sizes in each county are available from the NRCS field offices in each state. Data are from the latest available Census of Agriculture, Acreage of Farm Units in Operation with $1,000 or more in sales.)

As large or larger	10 points
Below average deduct 1 point for each 5 percent below the average, down to 0 points if 50 percent or more below average	9 to 0 points

(6) If the site is chosen for the project, how much of the remaining land on the farm will become non-farmable because of interference with land patterns?

Acreage equal to more than 25 percent of acres directly converted by the project	25 points
Acreage equal to between 25 and 5 percent of the acres directly convened by the project	1 to 24 point(s)
Acreage equal to less than 5 percent of the acres directly converted by the project	0 points

(7) Does the site have available adequate supply of farm support services and markets, i.e., farm suppliers, equipment dealers, processing and storage facilities and farmer's markets?

All required services are available	5 points
Some required services are available	4 to 1 point(s)
No required services are available	0 points

(8) Does the site have substantial and well-maintained on-farm investments such as barns, other storage building, fruit trees and vines, field terraces, drainage, irrigation, waterways, or other soil and water conservation measures?

High amount of on-farm investment	20 points
Moderate amount of on-farm investment	19 to 1 point(s)
No on-farm investment	0 points

(9) Would the project at this site, by converting farmland to nonagricultural use, reduce the demand for farm support services so as to jeopardize the continued existence of these support services and thus, the viability of the farms remaining in the area?

Substantial reduction in demand for support services if the site is convened	25 points
Some reduction in demand for support services if the site is convened	1 to 24 point(s)
No significant reduction in demand for support services if the site is converted	0 points

(10) Is the kind and intensity of the proposed use of the site sufficiently incompatible with agriculture that it is likely to contribute to the eventual conversion of surrounding farmland to nonagricultural use?

Proposed project is incompatible to existing agricultural use of surrounding farmland	10 points
Proposed project is tolerable to existing agricultural use of surrounding farmland	9 to 1 point(s)
Proposed project is fully compatible with existing agricultural use of surrounding farmland	0 points

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
Florida State Office
2614 NW 43rd Street
Gainesville, FL 32606

PH 352-338-9500
FX 352-338-9574
www.fl.nrcs.usda.gov

December 10th, 2008

Rebecca S. Griffith
Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Re: C-111 Spreader Canal Project in Miami-Dade County

Ms. Griffith,

Enclosed are the AD-1006, Prime Farmland map, data tables, and supporting documentation for the Proposed C-111 Spreader Canal Project in Miami-Dade County, Florida.

Review of the Prime Farmland designation on the USDA-NRCS Soil Data Mart website indicates that there are no Prime Farmland soils within the Project Area. See attachment 1.

With the supporting documentation (attachment 2) provided by South Florida Water Management District (SFWMD) that the agricultural lands within the Project Area will not be re-leased for agricultural use (after 6.30.09), we are designating this site as not containing any Prime, Unique, Statewide, or Locally important farmland.

This designation has been discussed with Mr. Milton Cortez (State Soil Scientist, acting) and he concurs with this designation.

Additional maps, interpretations, and ratings can be obtained at the USDA-NRCS Web Soil Survey at: http://websoilsurvey.nrcs.usda.gov/app/.

Sincerely,

Rick

Rick Robbins
USDA-NRCS
Soil Scientist
Gainesville, Florida

w/ 2 attachments

Helping People Help the Land

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FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

February 13, 2009

Ms. Natalie Garrett
U.S. Army Corps of Engineers
Planning Division – Environmental Branch
Post Office Box 4970
Jacksonville, Florida 32232-0019

Re: SHPO/DHR Project File No.: 2009-165 / Received: January 15, 2009
Final: Ph*ase I Archaeological Survey, C-111 Spreader Canal, Miami-Dade County, Florida*
New South Associates, St. Augustine, Florida; November 3, 2008
Contract No. : W912EP-04-D-0030

Dear Ms. Garrett:

This office received and reviewed the final revised survey report in accordance with Section 106 of the National Historic Preservation Act of 1966 (Public Law 89-665) as amended in 1992; as well as Chapter 1A-46, *Florida Administrative.* We concur that the planned undertaking will have no effect on historic properties and no further identification or evaluation is required unless the project perimeters change.

If you have any questions concerning our comments, please contact Laura Kammerer, Deputy State Historic Preservation Officer for Review and Compliance, at 850-245-6333 or lkammerer@dos.state.fl.us.

Sincerely,

Frederick P. Gaske, Director, and
State Historic Preservation Officer

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

☐ Director's Office (850) 245-6300 • FAX: 245-6436
☐ Archaeological Research (850) 245-6444 • FAX: 245-6452
☒ Historic Preservation (850) 245-6333 • FAX: 245-6437

AUDUBON OF FLORIDA
EVERGLADES FOUNDATION
NATIONAL PARKS CONSERVATION ASSOCIATION
NATURAL RESOURCES DEFENSE COUNCIL
SIERRA CLUB FLORIDA
TROPICAL AUDUBON SOCIETY
WORLD WILDLIFE FUND

June 6, 2009

Department of the Army
Jacksonville District Corps of Engineers
Attn: Alisa Zarbo, Project Manager
Palm Beach Gardens Regulatory Office
4400 PGA Boulevard, Suite 500
Palm Beach Gardens, FL 33410

<*Sent via email to* alisa.a.zarbo@usace.army.mil>

Re: Permit Application No. SAJ-2005-9856 (IP-AAZ)

Dear Ms. Zarbo:

This letter is in response to the public notice regarding the permit application filed by South Florida Water Management District (SFWMD) pursuant to Section 404 of the Clean Water Act. We have reviewed the 90% Detailed Design Report for the C-111 Spreader Canal Western Project (Western Project), which describes the project's infrastructure in great detail, and we believe it is capable of delivering the volume of flow needed to generate an ecological response in the downstream ecosystem. As stated in the application, the project is intended to improve the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough. The Frog Pond Detention Area (FPDA) and Aerojet canal features will work together to form a hydraulic ridge just east of Everglades National Park to reduce seepage out of Taylor Slough. The FPDA is a 590 acre infiltration area that will provide approximately 1,200 acre feet of storage while the extension of the Aerojet canal will continue this hydraulic ridge south by utilizing the existing canal. Avoidance and minimization of damage to wetlands have been employed by several features of the project, such as utilizing the existing Aerojet canal to form a seepage barrier and positioning the extension channel to reach the canal on an existing dirt road.

While the hydraulic ridge formed by project operation should greatly diminish the amount of seepage out of Everglades National Park and into the C-111 canal, the key to successful operation of Phase I will be an increase in stages at S-18C. As described in the application, incremental operational changes are planned at S-18C, although the detailed operational plan is not included in this application. The project operations must eventually raise canal stages to levels that demonstrate measurable ecological responses. The SFWMD has committed to operating the Western Project in an incrementally adaptive manner, and project operation constraints must be overcome and flows increased until the ecosystem responds. If the components of this project are operated sufficiently, we believe any wetland impacts resulting from the approval of this application will be offset by the downstream ecological lift.

Specifically, this project has the potential to produce freshwater flows that will significantly increase the salinity buffering capacity in the Northeastern Basin of Florida Bay. Examples of measures of success include reduced and shorter intervals of hypersaline, or greater than 35 psu, conditions at the Everglades National Park Taylor River hydrological monitoring platform and less saline conditions at the mouth of Little Madeira Bay. Freshening of the now brackish ecotonal wetlands will begin to reverse the current trends of high salinities, long periods of saline intrusion, and short hydroperiods and give way to a more productive and diverse assemblage of submerged aquatic vegetation (SAV), particularly an increase in *Ruppia maritima*. More frequent periods of freshwater dominance across the ecotonal wetlands will result in an increase in the freshwater fish community and, thus, the productivity of the region. Ultimately, reducing the damaging influence of the C-111 canal by operation of the Western Project will produce a response in a key estuarine indicator species: the roseate spoonbill. Successful project operation will increase the rate and success of nesting in northeastern Florida Bay.

Again, if the project is operated to meet ecosystem restoration goals, the benefits to Taylor Slough and northeastern Florida Bay will far outweigh any impacts associated with construction and operation. We note, however, that as a result of former and nearby agricultural practices, copper was found in the FPDA soils in concentrations that could contribute to adverse effects for wildlife. We expect this permit, if issued by the Corps, will address this issue and make recommendations as to how to best minimize potential impacts and protect the water quality of nearby Everglades National Park.

Finally, we re-emphasize that the following organizations strongly support this project. The C-111 Spreader Canal project is a critical component of restoring the southern Everglades and Florida Bay, which are continuing to exhibit symptoms of severe ecological decline. This project is the only immediate opportunity to begin to reverse the accumulated damage resulting from decades of diversion of fresh water away from its natural entry point into Florida Bay. The information gathered from adaptive implementation of this project will guide the planning efforts for the second phase of the project and continued ecosystem restoration. Thus, it is imperative to move this project towards completion and implementation and begin planning with all possible speed for the continued restoration that Phase II (the eastern component) will bring.

We thank you for your consideration of our comments.

Sincerely,

<Signatures waived to expedite delivery>

2

Jerry Lorenz
State Director of Research
Audubon of Florida
115 Indian Mound Trail
Tavernier, FL 33070

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Tropical Audubon Society
5530 Sunset Drive
Miami, FL 33143

Debra S. Harrison
Director, Florida Program
World Wildlife Fund
32 Mutiny Place
Key Largo, FL 33037

3

June 23, 2009

Ms. Alisa Zarbo
US Army Corps of Engineers
Palm Beach Gardens Regulatory Office
4400 PGS Boulevard, Suite 500
Palm Beach Gardens, FL 33410

Dear Ms. Zarbo,

On June 6, 2009, a letter was submitted to the U.S. Army Corps of Engineers (USACE) in response to the public notice, published by the USACE (dated May 7, 2009) regarding the permit application for the C-111 Phase 1 Project submitted by the South Florida Water Management District (SFWMD). Specifically the stakeholders identify concerns with copper concentration in soils identified in the Frog Pond Detention Area (FPDA) and the potential affects on wildlife and downstream water quality. The SFWMD provides the following response to the comments and concerns stated in the above mentioned letter.

An ecological risk assessment (ERA) on the C-111 Phase 1 project has been completed by NewFields LLC in January 2009. The ERA included toxicity and bioaccumulation tests which were conducted on the soils within the FPDA. The testing identified no toxicity to benthic macroinvertebrates from copper at concentrations observed within the project footprint. Bioaccumulation testing of apple snails suggests that the potential for risk to snail kites feeding on them within the future FPDA is also expected to be low. A copy of the ERA was submitted to the USFWS for review and comments on March 30, 2009.

The ERA also concluded that soil removal (through scraping) would further reduce the potential for risks to USFWS trustee species and to a future aquatic community. The ERA supported soil removal as a means to minimize the potential for unacceptable ecological risk to the Service trustee species by removing much of the mass of copper in those soils. This approach has received concurrence from the USFWS in a letter dated May 27, 2009.

A soil management plan is currently being drafted for the management of the impacted soils that will be excavated during the construction of the FPDA. The plan details to excavation, re-location and confirmation sampling activities. A copy of the soil management plan will be submitted to the USFWS and FDEP for review and approval.

In order to confirm there are no issues with the sites, the water quality monitoring plan has been revised to include a quarterly grab sample at the south end of the FPDA header channel and one in the Aerojet Canal after the culvert crossing under Aerojet Road. The SFWMD has revised the water quality monitoring plan to include analyzing zinc and copper as part of the quarterly Frog Pond grab sample analysis. Prior to construction, soils will be scraped to the limestone cap rock. Confirmation samples will be collected to show that upper bound estimates of area-weighted copper concentrations are at or below the benchmark for the protection of the Everglades snail kite.

To date, a Pilot Study for the excavation and re-location of soils at the Frog Pond Area has been conducted as well as additional soil sampling in the vicinity of the proposed Detention Area and an ERA of the Frog Pond. It should be noted that the above referenced documents have been submitted and reviewed by the USFWS and that the USFWS has concurred with the recommendations for soil scraping.

Ensuring the protection of aquatic resources continues to be a high priority for the SFWMD throughout the CERP planning and development process. We remain committed to working with agencies involved and stakeholders in continuing the successful restoration of the Everglades.

Sincerely,

Georgia Vince
Section Leader
Everglades Restoration Resource Area

cc:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

June 8, 2009

Dr. Rebecca S. Griffith
Chief, Planning Division
U.S. Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, FL 32232-0019

ATTN: Bradley Tarr

Subject: EPA Review of the COE's "C-111 Spreader Canal Western Project Draft Project Implementation Report and Environmental Impact Statement"; CEQ# 20090117; ERP# COE-E39078-FL

Dear Dr. Griffith:

Pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Army Corps of Engineers' (COE) Draft Environmental Impact Statement (DEIS) for the subject C-111 Spreader Canal (C-111 SC) Western Project. This Comprehensive Everglades Restoration Plan (CERP) project sponsored by the South Florida Water Management District (SFWMD) has changed from its original Restudy design and was divided into a Western and Eastern Project. The present Western Project primarily addresses changes in western flows through Taylor Slough to restore wetlands and to moderate/stabilize salinities in Florida Bay. The prospective Eastern Project is to cover the remaining project area and ultimately include the backfilling of the C-111 Canal.

Concurrently with this DEIS, EPA also received a copy of the Draft Environmental Assessment (DEA) on the "C-111 Spreader Canal Design Test", which will serve as a pilot study for the design of the Eastern Project. The Spreader Canal feature will not be implemented under the current C-111 SC Western Project but is expected to be a major component of the overall project. We support such pilot studies and will defer the finalization of the DEA to the COE, since we assume that the resultant Final EA (FEA) will be consistent with the objectives of the present DEIS and improve water quantity and quality in the project area. Accordingly, we recommend that the development of the FEA remain within the context of the DEIS and apply our present comments on the DEIS as appropriate.

Background

The DEIS for the C-111 SC Western Project addresses the restoration of the ecological functions of Taylor Slough and Florida Bay in the Everglades National Park (ENP), for the benefit of Florida Bay, Southern Glades, Model Land and other wetland and estuarine areas. The Western Project is essential in the CERP restoration of downstream waters to Florida Bay through Taylor Slough using available waters. The project would function to regulate and improve the quantity, timing and distribution (QTD) of these flows and to increase hydroperiods. Several structural changes are proposed, including the creation of a nine-mile-long hydraulic ridge east of the ENP and a water control structure in the lower portion of C-111, as well as modifications of existing S-18C, S-20, S-20A and the C-110 Canal. The hydraulic ridge is to consist of the Frog Pond Retention Area and Aerojet Canal west of the C-111 Canal, and their pumping stations. This ridge is to prevent groundwater flows from entering the Canal from the ENP, so that the groundwater is retained in Taylor Slough for downstream conveyance. Also, the C-110 Canal east of the C-111 Canal will be filled periodically with 10 earthen plugs to promote downstream re-hydration flooding and sheet flow of its waters.

EPA supports the C-111 SC Western (and prospective Eastern) Project. We recognize the restoration benefits of wetland re-hydration and increased hydroperiods, and the diversion of flows to Florida Bay through Little Madera Bay and Joe Bay to moderate and stabilize salinity for their estuarine flora and fauna. Moreover, the project would re-hydrate the wetlands of the Model Lands enabling thousands of wetland acres to function better and become available for mitigation banking. Compared to the current C-111 Canal discharges into receiving waters, diversion of these canal waters should also improve downstream water quality by creating overland sheet flow. We also understand that project pumping will be controlled to accommodate a project constraint to maintain acceptable low water depths for the endangered Cape Sable Seaside Sparrow. Overall, this proposal would affect some 155,000 acres of uplands, wetlands and estuarine areas (pg. 2-2), and include 776 acres of private land acquisition by the SFWMD sponsor. Response times for re-hydration and salinity-moderation benefits could range from immediate for some sessile and opportunistic species to a slower rebound of up to 10 years for others that would eventually colonize the area or that have long life cycles.

Alternatives

The COE's Recommended Plan (=NEPA preferred alternative) proposed in the DEIS is Alternative 2D Short (2DS), which is a modification of the original Alternative 2D. Alternative 2DS proposes a shorter Aerojet Canal feature that is more compatible with the volume of water available. The original Alternative 2D was consequently renamed as Alternative 2D Long (2DL).

Overall, EPA believes that Alternative 2DS is a reasonable environmental and economic selection. Of the final array of alternatives (1C, 1D, 3D, 2DL, 2DS, 6D), it provides a high habitat unit benefit or "lift", second only to 6D. Alternative 2DS should

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also reduce salinity swings in Barnes Sound by reducing freshwater flows through S-197, but increase flows to Florida Bay to moderate salinities there to more historic levels. From a cost perspective, start-up and maintenance costs of Alternative 2DS and 6D were each characterized by the COE as a "Best Buy"; however, 2DS would cost considerably less and provides better relative benefit per habitat unit, even though 6D would benefit more habitat units. Moreover, 2DS is more flexible than 6D as it allows for easier implementation of adaptive management to help resolve uncertainties. Specifically, only 6D would implement a large permanent structure to prevent groundwater flows into the C-111 Canal, which would have to be de-constructed if adaptive management monitoring determines a need. Alternative 6D would also not satisfy the important project constraint of accommodating low water levels for the Seaside Sparrow, while 2DS would regulate its pumping accordingly.

Comments & Suggestions

Beyond the notable overall project benefits outlined above, we offer a few technical and editorial comments to improve the Final EIS (FEIS). Regarding technical issues, we recommend the following for the COE's consideration:

* Water Quality – From a water quality perspective, we note that the project's generation of overland sheet flow should improve water quality when compared to current canal discharges into receiving water bodies. We are also pleased that a project objective is to moderate the hypersaline waters of Little Madera Bay, Joe Bay and Florida Bay to more historic levels associated with estuarine waters. Moreover, we note (pg. 7-14) that total phosphorus levels are predicted to be low (about 5 ppb, compared to the Settlement Agreement standard of 8 ppb) for Taylor Slough waters entering Florida Bay due to ongoing upstream efforts. Regarding chemical contaminants that may be released during the flooding of project areas and affecting water quality of downstream flows, the Frog Pond Detention Area may have the greatest potential for concern. However, page 7-27 indicates that "...scraping to remove the maximum practical amount of soil from the wetted surfaces of the FPDA [Frog Pond Detention Area] would be sufficiently protective of ecological receptors" and that "[a]ll other elements of Alternatives 1D, 2D Short and 2D Long are free of HTRW [hazardous, toxic and radioactive waste] and site contamination issues." In addition to these benefits, EPA requests additional FEIS discussion on any other water quality benefits provided by the project or that would incidentally result from the project (e.g., sponsor land acquisition, removing this land from farming and potential development).

* Monitoring – Although project monitoring is referenced in the main document (e.g. Section 5.10.3 and 8.2.2), it is fully discussed in Annex E. While EPA finds this monitoring plan to be adequate overall, we offer the following comments:

+ *Figure E-2*: This figure is confusing and should be clarified in the FEIS to mesh with the accompanying Table E-1 and the discussion. On Figure E-2, the proposed structure S176B should be renamed to S-200, which is the 225 cfs intake pump to the 590-acre water detention basin (since there is no outlet structure, we note that all water

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pumped into the detention basin will seep into the surficial aquifer). Also, proposed S177B on Figure E-2 needs to be renamed to S199.

+ *Summary*: We suggest that the main document provide a short summary of the monitoring proposed for the project as well as related issues such as the ecological performance standards to be used to determine project success. Also, what is the process for implementing adaptive management for the project in terms of the timeframe required before a change is authorized and initiated?

* Environmental Justice (EJ) – Page 5-43 suggests that EJ populations would not be affected by the project and stated that "[s]takeholders meetings with the minority groups took place in 2003 to address concerns." However, these public concerns were not disclosed or referenced. Accordingly, it is difficult for the public to determine the absence of an EJ effect without such discussion. In addition, such 2003 outreach is now somewhat dated information and may have changed. We also note that page 6-14 indicates that no relocation assistance would be needed or required. The FEIS should more clearly indicate if any residents or businesses would be displaced by the project and, if so, the demographics of those people to be relocated.

* Invasive Species – Page 7-20 lists several non-native species such as *Melaleuca* that are present in the project area. The DEIS indicates (pg. 7-21) that "[a]ll of the alternatives include redistribution of freshwater into wetland communities that will retard the growth and spread of invasive, non-native plant species." While this may be true for certain species, certain invasives such as Brazilian Pepper would thrive in such environments. Similarly, *Melaleuca* was presumably intentionally introduced to south Florida many years ago to help convert wetlands to uplands. The FEIS should discuss if the project will attempt to control invasive species on the 776 acres of private lands that are to be purchased since these lands would become fallow and available for opportunistic invasive species.

* Cumulative Impacts – Cumulative impacts should discuss both negative and positive impacts. As a restoration project, the overall impact of CERP (and the present C-111 SC Western Project component) is positive. The discussion on page 7-32 should therefore be broadened in the FEIS to include the positive effects of other CERP projects relative to the subject C-111 SC Western Project. These include the prospective C-111 SC Eastern Project as well as the ongoing Modified Waters Delivery (MWD) Project and others intended to re-hydrate the Everglades and restore flows to Florida Bay.

Editorially, we suggest additional language for clarity in areas such as the following:

* Barnes Sound Water Quality – Page 5-38 states that "...supplemental data from the environmental evaluation suggests that Alternative 6D would cause substantial damage to Barnes Sound." However, the type and magnitude of this damage was not discussed or referenced. Based on Section 7, we note that such damage would be salinity related since 6D would still allow high flows through S-197 (pg. 7-16 and Table 7-2) and

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discharges into Barnes Sound, which lowers ambient salinities at the outfall and impacts local marine inhabitants. We suggest that the said "damage" be briefly described (e.g., salinity reductions due to discharges) or that the Section 7 discussion be referenced.

* Florida Bay Salinities – Page 5-45 states that "...the benefit analysis indicates there could be a decline in salinity conditions for the eastern portions of the Florida Bay as more water is redistributed to the western portion of the project area." We suggest that "a decline in salinity conditions" be defined parenthetically or replaced with what we assume is intended to mean "an increase in the hypersalinity conditions".

EPA DEIS Rating

We rate this DEIS as an "LO" (Lack of Objections). EPA supports the C-111 SC Western Project. We believe that this project and its prospective Eastern Project counterpart should benefit the CERP recovery of the Everglades and Florida Bay.

EPA appreciates the opportunity to review the DEIS. Should you have questions regarding these comments, feel free to contact Chris Hoberg of my staff for NEPA issues (404-562-9619 or hoberg.chris@epa.gov) and Eric Hughes of the EPA Water Protection Division (located in the Jacksonville District office) for technical issues (904/232-2464 or Eric.H.Hughes@usace.army).

Sincerely,

Heinz J. Mueller, Chief
NEPA Program Office
Office of Policy and Management

Florida Department of
Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

June 12, 2009

Mr. Brad A. Tarr
Jacksonville District, Planning Division
U. S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, FL 32232-0019

RE: Department of the Army, Jacksonville District Corps of Engineers – Draft Integrated Project Implementation Report and Environmental Impact Statement (PIR/EIS) for the C-111 Spreader Canal Western Project – Miami-Dade County, Florida.
SAI # FL200904304722C

Dear Mr. Tarr:

The Florida State Clearinghouse has coordinated a review of the Draft PIR/EIS under the following authorities: Presidential Executive Order 12372; Section 403.061(40), *Florida Statutes*; the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended; and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended.

The Florida Department of Environmental Protection (DEP) has participated in the Project Delivery Team and notes that, although staff supports moving forward with construction of the recommended plan, Alternative 2DS, several issues identified in the enclosed memorandum must first be addressed in the Final PIR. DEP staff requests further clarification on: the applicability of the original project objectives; whether additional water is or is not made available for the natural system and, if so, use of flow transects and structure discharges to quantify deliveries to the natural system; how the objectives for water supply for the environment as required for CERP projects will be met under WRDA 2000, the Programmatic Regulations and other applicable federal and state law; the degree and type of unavoidable adverse impacts being offset by restoring and rehydrating a larger extent of freshwater and coastal wetlands; soil contaminant remediation and water quality monitoring plans. For further detailed comments and recommendations, please refer to the enclosed memorandum and contact Ms. Amanda Watson at (850) 245-8350.

The Florida Department of Agriculture and Consumer Services (FDACS) has expressed concerns regarding the potential for negative impacts to privately owned agricultural

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Mr. Brad A. Tarr
June 12, 2009
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properties from elevated groundwater levels, which could result in root zone flooding and crop failure. Since the PIR's recommended plan does not include funds for the purchase of private lands impacted by the project, special care must be taken to avoid negative consequences that would accompany an increase in groundwater levels on private agricultural properties. FDACS requests additional information on the adverse impacts and "alteration of agricultural requirements" resulting from the proposed increased hydroperiods. The USACE is advised to not consider any alternative that adds flooding risk to private agricultural property to achieve "increased hydroperiods" on public land. Many area growers have taken the position that agricultural lands should be purchased if the integrity of private land interests is threatened and property value is diminished. Please see the enclosed FDACS memorandum for additional information.

Based on the information contained in the Draft PIR/EIS and enclosed state agency comments, the state has determined that, at this stage, the proposed federal action is consistent with the Florida Coastal Management Program (FCMP). The concerns identified by our reviewing agencies must be addressed, however, prior to project implementation. The state's continued concurrence with the project will be based, in part, on the adequate resolution of issues identified during this and subsequent reviews. The state's final concurrence of the project's consistency with the FCMP will be determined during the environmental permitting stage.

Thank you for the opportunity to review the subject document. Should you have any questions regarding this letter, please contact Mr. Chris Stahl at (850) 245-2169.

Yours sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/cjs
Enclosures

cc: John Shaffer, SFWMD
John Outland, DEP, MS 45
Ernie Marks, DEP, MS 3560
Tim Gray, DEP, Southeast District
W. Ray Scott, FDACS
Forrest Watson, FDACS, DOF

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Project Information	
Project:	FL200904304722C
Comments Due:	06/03/2009
Letter Due:	06/12/2009
Description:	DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT CORPS OF ENGINEERS - DRAFT INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT (PIR/EIS) FOR THE C-111 SPREADER CANAL WESTERN PROJECT - MIAMI-DADE COUNTY, FLORIDA.
Keywords:	ACOE - DIPIR/EIS, C-111 SPREADER CANAL WESTERN PROJECT - MIAMI-DADE CO.
CFDA #:	12.106

Agency Comments:
SOUTH FL RPC - SOUTH FLORIDA REGIONAL PLANNING COUNCIL
No Comments
AGRICULTURE - FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES
The FDACS has expressed concerns regarding the potential for negative impacts to privately owned agricultural properties from elevated groundwater levels, which could result in root zone flooding and crop failure. Since the PIR's recommended plan does not include funds for the purchase of private lands impacted by the project, special care must be taken to avoid negative consequences that would accompany an increase in groundwater levels on private agricultural properties. FDACS requests additional information on the adverse impacts and "alteration of agricultural requirements" resulting from the proposed increased hydroperiods. The USACE is advised to not consider any alternative that adds flooding risk to private agricultural property to achieve "increased hydroperiods" on public land. Many area growers have taken the position that agricultural lands should be purchased if the integrity of private land interests is threatened and property value is diminished.
COMMUNITY AFFAIRS - FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS
FISH and WILDLIFE COMMISSION - FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
NO COMMENT BY CHUCK COLLINS ON 6/1/09.
STATE - FLORIDA DEPARTMENT OF STATE
No Comment/Consistent
TRANSPORTATION - FLORIDA DEPARTMENT OF TRANSPORTATION
FDOT staff has no comments - per Barbara B. Culhane, M.S., A.I.C.P., Senior Environmental Project Manager, Florida Department of Transportation, District Six.
ENVIRONMENTAL PROTECTION - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
The DEP has participated in the Project Delivery Team and notes that, although staff supports moving forward with construction of the recommended plan, Alternative 2DS, several issues identified in the enclosed memorandum must first be addressed in the Final PIR. DEP staff requests further clarification on: the applicability of the original project objectives; whether additional water is or is not made available for the natural system and, if so, use of flow transects and structure discharges to quantify deliveries to the natural system; how the objectives for water supply for the environment as required for CERP projects will be met under WRDA 2000, the Programmatic Regulations and other applicable federal and state law; the degree and type of unavoidable adverse impacts being offset by restoring and rehydrating a larger extent of freshwater and coastal wetlands; soil contaminant remediation and water quality monitoring plans. For further detailed comments and recommendations, please refer to the enclosed memorandum and contact Ms. Amanda Watson at (850) 245-8350.
SOUTH FLORIDA WMD - SOUTH FLORIDA WATER MANAGEMENT DISTRICT
The SFWMD is a partner with the USACOE in this project; therefore, a consistency determination is not necessary.

Memorandum

TO: Florida State Clearinghouse

THROUGH: Ernie Marks, Administrator
Restoration Planning and Permitting

FROM: John Outland, Katie Higgs, Inger Hansen, Annet Forkink, Stacey Feken

DATE: June 12, 2009

SUBJECT: USACE – Draft Integrated Project Implementation Report and Environmental Impact Statement (PIR/EIS) for the C-111 Spreader Canal Western Project – Miami-Dade County, Florida

SAI #: FL09-4722C

BACKGROUND

In April of 2009 the Jacksonville District U.S. Army Corps of Engineers (USACE) published a Draft Integrated Project Implementation Report (PIR) and Environmental Impact Statement (EIS) for the Central and South Florida Project, Comprehensive Everglades Restoration Plan (CERP) C-111 Spreader Canal Western Project. A Request for Department comments was received through the State Clearinghouse on April 30, 2009. The C-111 Spreader Canal Project is being implemented in two phases through two separate PIRs and the currently proposed C-111 Spreader Canal Western project PIR is the first of the two planned phases.

The C-111 Spreader Canal Project was one of the ten initial projects authorized as a component of CERP under the Water Resources Development Act (WRDA) of 2000. The main purposes of the original CERP project as identified in the yellow book were to improve water deliveries and enhance connectivity and sheetflow in the Model Lands and Southern Glades Area, reduce wet season flows in C-111, and decrease potential flood risk in the lower south Miami Dade County area. The future planned second phase of this project, C-111 Spreader Canal Eastern PIR, will address the aforementioned original CERP project purposes.

In May of 1994, the USACE published the Final Integrated General Reevaluation Report and Environmental Impact Statement for the Canal 111 (C-111 GRR). The GRR Report recommended implementing Alternative 6A to help protect the natural values associated with Everglades National Park and maintain flood damage prevention within the lower C-111 basin. This project was authorized by Congress in the Water Resource Development Act (WRDA) of 1996. Since then many of the C-111 GRR project features have been constructed, including the Taylor slough bridge, the S-332 pump station, the S-332 B and C pump stations and associated S-332's Detention Areas. The project is still under construction and since 2002 this project has

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been operating under the Interim Operation Plan (IOP) for the protection of the Cape Sable Seaside Sparrow.

The PIR for the C-111 Spreader Canal Western Project identifies Alternative 2DS as the recommended plan. This plan includes the construction of a number of new features that will southwardly extend the existing S-332 Detention Area's hydraulic ridge that was originally built under the C-111 GRR Authorization.

The recommended plan includes the construction of the Frog Pond Detention Area (FPDA), an Aerojet Canal storage feature, and an operable structure in the lower C-111 Canal. These features, together with raising water levels at S-18C, are intended to work in unison to create a hydraulic ridge from S-132 southward. The main purpose of establishing this ridge is to prevent groundwater seepage from Everglades National Park from moving into the C-111 Canal, therefore retaining water in Taylor Slough and improving the quantity, timing, and distribution of flows into Florida Bay. This goal is consistent with what was authorized under the C-111 GRR. The Frog Pond Detention Area is located on lands that were authorized for acquisition under the C-111 GRR.

Additional proposed features include the construction of one plug at S-20A in the L-31 canal and ten plugs in the C-110 Canal. These features, together with operational changes at S-18C and S-20, will provide environmental benefits to the Southern Glades and Model Lands by reducing the drainage effects of the canals. These features meet some of the original objectives of the C-111 Spreader Canal Project as envisioned in the CERP yellow book. However, the proposed project does not achieve the original identified objectives of improving water deliveries and enhancing connectivity and sheetflow in the Model Lands and Southern Glades Area. This objective can only be achieved by moving forward with the C-111 Spreader Canal Eastern project.

The review and comments provided below do not constitute the State's formal review of CERP project components as required by state law under §373.1501 and §373.026, Florida Statutes (F.S.). Please note that the §373.026/1501, F.S., review is separate from the Florida State Clearinghouse review required for all federal projects under the Coastal Zone Management Act, and requires a formal submittal from the South Florida Water Management District (SFWMD) to the Department.

COMMENTS

The Department has participated in the Project Delivery Team (PDT) and supports moving forward with construction of the recommended plan, Alternative 2DS; however, several issues need to first be addressed in the final PIR as discussed below.

The C-111 Spreader Canal project was originally identified as a Category A project per CERP Guidance Memoranda 23, Water Quality Considerations for the Project Implementation Report Phase (CGM 23). The PIR states that the original project objectives were to "provide

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ecologically compatible water quality consistent with the restoration goals and federal and state requirements applicable to the Southern Glades, Model Lands and ENP." When the Project Delivery Team was directed to reformulate the C-111 project to achieve the newly established Western Project goals and objectives, it was not made clear in the PIR how or why the previously identified objectives no longer applied.

Page xiii, under *Water for the Natural System and Other Water-Related Needs*, states that *there are no features to capture run-off or excess discharges as in other CERP projects*. However, one of the project components, Frog Pond, consists of the creation of a 590 acre above-ground detention area. This project component is designed to route excess water to a three-cell detention area rather than being discharged to the lower C-111 Canal. This component will function to extend the hydroperiod in the headwater area of Taylor Slough. Similarly, excess water from the C-111 will be routed to the Aerojet Canal by the S-199 pump station to ensure that a hydraulic head is maximized along the length of the canal. While the project components are designed to redistribute water currently available in the project area, they both appear to capture excess water flows from the C-111 canal. Please explain. In addition, the PIR is unclear both in the Executive Summary and in applicable text throughout the document as to whether additional water is or is not made available for the natural system. Please address accordingly.

Page xiii, under *Water for the Natural System and Other Water-Related Needs*, states that *there are no features to capture run-off or excess discharges as in other CERP projects*. This claim suggests that since there are no features to capture runoff or excess discharges that no additional water will be made available for the natural system. This appears to not be supported by the modeling results provided. Specifically, average annual structure flows as predicted by the existing conditions and future conditions were compared to the proposed alternatives, and a summary table of average annual flow conditions was provided in Appendix C (Table C-15). The recommended plan significantly reduces the volume of damaging discharges out of the S-197 structure, both for existing conditions and future conditions. When comparing the existing condition to the Alternative 2DS (assuming IOP still applies), the average annual discharge volume is reduced by approximately 60 percent. For future conditions, annual discharge volumes are reduced by 70 percent, or 165,725 ac-ft/yr. These reductions in discharges are significant and it seems important to make a distinction between what reaches Manatee and, ultimately, Florida Bay through canal discharges to tide, versus the volume discharged to Florida Bay by improving flows through Taylor Slough. The Department recommends using all of the flow transects that were established, as well as the structure discharges, to quantify deliveries to the natural system.

Please note that the Programmatic Regulations (§385.28 (c)(xvii)) require the PIR to include as appropriate, information necessary for the non-Federal sponsor to address the requirements of Chapter 373, F.S., and other applicable planning and reporting requirements of Florida law. Please clarify the inconsistencies described above and explain further how the objectives for water supply for the environment as required for CERP projects pursuant to WRDA 2000, the Programmatic Regulations and other applicable Federal and State law will be met for this project. Please identify the increase in water supply made available by the project pursuant to

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§373.470, F.S., and discuss how this water will be reserved for the natural system pursuant to §373.223, F.S.

The recommended plan was selected based on the anticipated environmental benefits associated with improved water deliveries to Taylor Slough and the reduction of harmful discharges from the C-111 to Manatee Bay caused by opening the S-197 structure. The proposed operation plan suggests that new trigger level gauges are established at a location within potentially affected sparrow habitat areas and that the pumps that are supposed to feed water to the proposed hydraulic ridge shut down once the gauges reaches a depth of 10 cm above ground during the nesting season. The Department supports the establishment of a monitoring program to evaluate stages and conditions in both the deeper sloughs and the more elevated areas where sparrow habitat exists. Please recognize however that the ecological benefits of restoring the sloughs may not be fully achieved if the hydraulic ridge is not maintained during the sparrow-nesting season. The cut back on stages or pumping levels during the nesting period should be considered, however, cutbacks should take into consideration the evaluation of the affected portions of the ecosystem as a whole.

The purpose of avoiding the establishment of rigid on and off triggers for sparrow habitat gauges can perhaps be best illustrated by looking at the conditions of the Sparrow Subpopulation D habitat where under existing conditions, during many years the conditions are simply too wet for the sparrows to nest. Shutting down pumping at the proposed Aerojet Canal or the Frog Pond Detention Area will not improve the conditions for the Sparrow subpopulation D during these wet years. However, shutting down the pump stations would likely diminish the project benefits where we would no longer be able to establish the hydraulic ridge which the project was intended to establish. Maintaining the hydraulic ridge not only during the wet season but also the dry season is critical for ecological benefit.

It should be noted that the variation in ground elevation across the sparrow habitat is much more than 30 cm due to micro-topography that exists in the Rocky Glades and the Southern Glades. The Department believes that it is appropriate to establish monitoring gauges both in the existing sparrow habitat and along the sloughs to ensure that all project objectives are met. However, the proposed restoration plan may not be as effective if operational protocol is solely based on the management of the sparrow.

In the Executive Summary under the *Major Findings and Conclusions* section it states the following, "Implementation of the recommended plan or other alternatives is expected to result in a degree of unavoidable adverse impacts." The meaning of this statement is not clear; more details should be provided accordingly. Furthermore, the statement, "These impacts, however, would be offset restoring and rehydrating a larger extent of freshwater and coastal wetlands," is vague. It is not clear what adverse impacts are being offset (e.g. are the direct wetland impacts caused by the project construction). Please explain. Please note that impacts to privately owned lands cannot be mitigated by environmental benefits of the project.

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A Draft Project Operation Manual (POM) was provided in Annex D. This Draft POM includes operational protocol for all of the structures associated with the C-111 Canal Basin including operation of the S-332B, S-332C and S-332 D pump stations. The operation plan states that the connector cell between the S-332B West Detention Cell and S-332C Detention Cell is incomplete. Similarly, the connector between the S-332 C Detention Cell and the S-332D Detention Cell are also not included. Since Contract 7 of the C-111 Project has been completed, the text in the operation manual and Figure D-3 should be updated to include these features.

The capacity of the expanded S-332 Detention Area needs to be recognized in the operation plan and some of the pump constraints should be revisited accordingly. As part of recent coordination for the development of the operation plan for the 8.5 Square Mile Area (SMA) Projects, the SFWMD suggested that language be added to the proposed operation plan to recognize the improved capacity in the S-332's Detention Areas further south. Please coordinate this with the SFWMD.

Appendix D of the C-111 Spreader Canal Western PIR Report contains a Real Estate Analysis, and a map (Figure D-3) of impacted lands. There is no label on the map to explain what the different colors indicate. Further, the scale of the map is not suitable to clearly show which parcels will be affected. The Department recommends providing a better description regarding how the map was generated, and what it demonstrates. The text in the real estate section refers to the analysis that was done comparing Existing Conditions Dec 2000 to the recommended plan Alternative 2DS. However, none of the model runs were provided (other than the map referenced above). Please provide details of the model runs and a clear description of what assumptions were made for the "Existing Conditions Dec 2000".

Section 3.3.2 of the main report refers to Water Management (operations). This chapter provides a confusing explanation of what project assumptions and conditions apply to the different scenarios. It is not clear what constitutes existing conditions, 2000 base conditions, and/or what is assumed for future conditions. A better explanation should be provided.

Department staff was not able to preview the details of the modeling runs that were conducted for the saving clause analysis. However, from the information presented we understand that the Corps carried out a modeling scenario for the 2000 ISOP operational conditions, which is different from the current operation (IOP). If the modeling conducted does not represent the 2000 ISOP conditions, an explanation needs to be provided. The Modbranch modeling that was presented in Appendix A did not simulate the 2000 Base condition. Instead, the Engineering Appendix presented the existing condition (IOP) modeling scenarios. Please explain.

Section 1.5.2-Modified Water Deliveries (MWD) to Everglades National Park Project states that while "the MWD project will influence the C-111 SC project, the only direct effects that will occur are possible increases in the amount of water available to the proposed C-111 SC Western project area. Additionally, water available to the C-111 SC project may be improved in quality." The possible increases in water to the C-111 SC should be quantified, as additional planning may be needed.

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Per *Section 6.1.3.4-C-110 Canal Plugs*, earthen plugs at ten key locations within the C-110 Canal will be constructed to promote sheet flow within the Southern Glades. Possible contamination impacts of the spoil material should be assessed to avoid potential adverse impacts on water quality upon completion of the plugs and commencement of sheetflow.

According to the *Ecological Risk Assessment of Frog Pond Soils (January 2009)*, a portion of the Frog Pond property is leased and is actively cultivated by commercial vegetable farmers. The PIR/EIS should address whether or not this farming activity will continue during and after construction of the C-111 SC Western Project.

The *Environmental Site Assessment* (2006) for Frog Pond revealed that barium, cadmium, copper, chromium, lead, zinc, and various pesticides exceeded screening-level risk-based benchmarks in at least one sample within the study area. Soil scraping was proposed as a method of remediation. However, even with scraping these contaminants may remain in the sediment. Please coordinate with the District and DEP's Waste Cleanup Section for comments and recommendations on the removal, disposal and/or monitoring of contaminated material.

The following questions and comments are in reference to *Annex E-Draft Project Monitoring Plan, Part 2-Regulatory Plan: Water Quality Compliance* and should be answered in the Final PIR/EIS:

A. Please explain why the plan calls for NH4 sampling at two critical stations - S-177 and S-178.
B. Per *Section E.1.4*, baseline dataset sampling for NH4 will be initiated In October 2009. The duration of the monitoring should be specified.
C. In *Section E.2-Geographic Location*, the regional area for the C-111 Spreader Canal Western project should be mentioned rather than just the Project PIE. To that end, more background information should be given on the PIE monitoring plan. For the purposes of the permit application/water quality monitoring plan review, the document should be submitted to the Department.
D. The stations shown in Figure E-2 do not match the stations given in Table E-1. These stations should be shown in context to the proposed plan features. For regulatory purposes, the plan should also include flow, stage, and rainfall data.
E. Please describe what monitoring is proposed to occur during construction.
F. Please describe what parameters are included in the pesticide suite.
G. Please explain why surface water quality samples are taken at S-177 but not at pump station S-199.
H. The water quality monitoring plan should address the inclusion of grab samples within the two "detention areas" downstream until we have established that there are no issues with the sites. Consider adding one site in the FPDA at the south end of the header channel and one in the Aerojet Canal after the culvert crossing under the road. Zinc and copper should be included as parameters for the FPDA.
I. Please explain how the guidance from CERP Guidance Memoranda #42, Toxic Substances Screening Process - Mercury and Pesticides, will be incorporated into the monitoring plan. The current plan does not include any fish tissue or sediment monitoring for Hg.

Florida State Clearinghouse
June 12, 2009
Page 7 of 7

The Department is currently reviewing the CERPRA permit application from the SFWMD pursuant to §373.1502, F.S. Issuance of the CERPRA permit will be required for this project prior to construction. During the planning process, please note that reasonable assurances must be provided to ensure that any discharges from the project will meet the State's water quality standards.

The Department would like to reiterate its support for moving forward with the construction of the C-111 Spreader Canal Western Project. We look forward to the above comments being considered and addressed in the final PIR. As noted the Department does have additional questions about the current operation and monitoring plans and would recommend continual refinement of these plans to ensure that project benefits are achieved to the maximum extent practicable, while protecting and preventing private property from adverse impacts. Protection of threatened and endangered species is important to the Department, and monitoring should be considered to avoid adverse impacts. Stage triggers should be evaluated regularly to determine whether operational constraints are appropriate.

The Department sincerely appreciates the opportunity to comment. Should you have any questions on the comments provided, please feel free to contact Amanda Watson at (850) 245-8350.

Electronic copies to:
John Outland
Stacey Feken
Inger Hansen
Tim Gray
Annet Forkink
Tracey Robb
Greg Knecht
Katie Higgs
Ernest Marks

Florida Department of Agriculture & Consumer Services
CHARLES H. BRONSON, Commissioner

DATE: June 9, 2009

TO: Lauren P. Milligan, Environmental Manager
Florida State Clearinghouse

FROM: W. Ray Scott, Conservation and Water Policy Federal Programs Coordinator
Office of Agricultural Water Policy

RE: State Clearinghouse Review Comments – (SAI # **FL200904304722C**)
C-111 Spreader Canal Western Project Draft Integrated Project Implementation Report and Environmental Impact Statement (April 2009)

The Florida Department of Agriculture and Consumer Services (FDACS) appreciates the opportunity to provide comments on the C-111 Spreader Canal Western Project Draft Integrated Project Implementation Report (PIR) and Environmental Impact Statement (EIS) dated April 2009.

The potential for negative impacts to the privately owned agricultural properties in the vicinity of the project is our area of interest. FDACS is concerned that a rise in groundwater elevations could result in root zone flooding that will be detrimental to crops. However, the PIR's recommended plan does not include funds for the purchase of private lands impacted by the project so special care must be taken to avoid negative consequences that would accompany an increase in groundwater levels on private agricultural properties.

It is disconcerting to see the following statement on page x of the Executive Summary. "Implementation of the recommended plan or other action alternatives is expected to result in a degree of unavoidable adverse impacts. Specifically, increased hydroperiods will result in an alteration of agricultural requirements; and some existing wetlands would be permanently altered by the construction and excavation of project features. These impacts, however, would be offset by restoring and rehydrating a larger extent of freshwater and coastal wetlands." What does "alteration of agricultural requirements" mean? This area has a wide range of crop variety and crop seasonality. Cultivation includes fruit tree groves, seasonal vegetables and niche tropical and subtropical vegetables and fruits grown year round. The USACE should not consider any alternative that adds flooding risk to private agricultural property to achieve "increased hydroperiods" on public land.

Memorandum
June 9, 2009
Page 2 of 2

Growers projected to be within the area of the project impacts are particularly concerned about the possibility of irreversible harm and unintended consequences given the project unknowns and what they've seen of court ordered interventions in other areas. Some have taken the position that if the integrity of private land interests are threatened then the project should purchase the property rather than experiment with someone's livelihood and property value.

FDACS looks forward to the restoration success of the C-111 West Spreader Canal project and the ongoing viability of agriculture in south Florida.

Thank you for the opportunity to comment on the C-111 Spreader Canal Western Project Draft Integrated Project Implementation Report and Environmental Impact Statement (April 2009). If you have questions regarding FDACS' comments, please contact Ray Scott at (850) 410-6714 or Rebecca Elliott at (561) 682-6040.

COUNTY: MIAMI-DADE

DATE: 4/30/2009
COMMENTS DUE DATE: 6/3/2009
CLEARANCE DUE DATE: 6/12/2009
SAI#: FL200904304722C
REFER TO: FL200205131972C

MESSAGE: 2009-02599

STATE AGENCIES	**WATER MNGMNT. DISTRICTS**	**OPB POLICY UNIT**	**RPCS & LOC GOVS**
AGRICULTURE	SOUTH FLORIDA WMD		
COMMUNITY AFFAIRS			
ENVIRONMENTAL PROTECTION			
FISH and WILDLIFE COMMISSION			
X STATE			
TRANSPORTATION			

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

- **Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.**
- X **Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.**
- **Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.**
- **Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.**

Project Description:

DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT CORPS OF ENGINEERS - DRAFT INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT (PIR/EIS) FOR THE C-111 SPREADER CANAL WESTERN PROJECT - MIAMI-DADE COUNTY, FLORIDA.

To: Florida State Clearinghouse

AGENCY CONTACT AND COORDINATOR (SCH)
3900 COMMONWEALTH BOULEVARD MS-47
TALLAHASSEE, FLORIDA 32399-3000
TELEPHONE: (850) 245-2161
FAX: (850) 245-2190

EO. 12372/NEPA

- [x] No Comment
- [ ] Comment Attached
- [ ] Not Applicable

Federal Consistency

- [x] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:

Division/Bureau: Historic Resources

Reviewer: Michael Hart Laura A. Kammerer, Deputy SHPO

Date: 6/3/09 6.3.2009

RECEIVED BUREAU OF HISTORIC PRESERVATION 2009 MAY -6 P 12:14

RECEIVED JUN 08 2009

The Nature Conservancy
Protecting nature. Preserving life.

The Nature Conservancy
Florida Chapter
P.O. Box 118526
Gainesville, FL 32611

tel [352] 392-5949
fax [352] 846-1344

nature.org/florida

June 22, 2009

Mr. Brad Tarr
Planning Division, Environmental Branch
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Tarr:

The Nature Conservancy appreciates the opportunity to provide comments on the C-111 Spreader Canal Western Project (Project) draft Project Implementation Report (draft PIR) and Environmental Impact Statement. As we are currently unable to provide a full review of the document, we have focused on issues associated with the Cape Sable seaside sparrow. This federally listed species was the only species whose designated critical habitat was determined likely to be adversely affected by the Project. (Annex 4).

Given this determination, we urge that the hydrologic, vegetation and population monitoring recommendations in Annex 2 be implemented. Further, the Cape Sable seaside sparrow management and mitigation plan for the C-111 Spreader Canal Project study area should be developed as recommended. If sub-populations C and D are likely to be displaced as higher water levels or longer hydroperiods in those areas result in changes in habitat, it is critically important that alternate habitat be identified at sites that are not likely to be impacted by the Project. We suggest that restoration of historic marl prairie on the eastern portion of the Model Lands (South Dade Wetlands) may be appropriate mitigation for critical habitat lost to the sparrow. As such, planning and funding for the restoration effort, which would include removal of exotic invasives and woody vegetation, intensive fire management and possibly some wetland restoration, should be incorporated into this Project PIR.

Please contact me if you have questions regarding these comments.

Sincerely,

Douglas T. Shaw, Ph.D.
Director, Conservation Science and Strategies

Wynn, Rudy E SAJ Contractor

From: Tarr, Bradley A SAJ
Sent: Tuesday, June 23, 2009 3:30 PM
To: Wynn, Rudy E SAJ Contractor
Subject: FW: C111 Western Spreader Canal draft PIR comments

Importance: High

Attachments: SDade_USGS_salt_intrusion_line_2008draft&1995.pdf

SDade_USGS_salt_i ntrusion_line...

-----Original Message-----
From: Markley, Susan M. (DERM) [mailto:markls@miamidade.gov]
Sent: Tuesday, June 23, 2009 1:34 PM
To: Tarr, Bradley A SAJ; C111SCComments@evergladesplan.org
Cc: Guerra, Cynthia (DERM); Burzycki, Gwen (DERM)
Subject: C111 Western Spreader Canal draft PIR comments
Importance: High

Miami-Dade Department of Environmental Resources (DERM) staff recognizes the strategic opportunity for timely completion of CERP and CERP-related projects and achieving restoration benefits for south Miami-Dade wetlands, Everglades National Park and the southern estuaries. We generally support the C-111 Western Spreader Canal Project, as the initial phase of the more comprehensive Spreader Canal project. However, we would also like to document some technical concerns related to salt intrusion and related potential impacts to urban wellfields, and maintenance of flood protection in some areas. In addition, although this announcement specifically addressed the PIR for the western portion of the project, our staff strongly supports continuing the effort to complete the eastern components, in order to achieve project objectives and address some of the issues that we have identified. Therefore, we are taking this opportunity to include some recommendations related to the development of the Eastern PIR. DERM staff looks forward to continuing to work with project stakeholders to ensure that adaptive management strategies for implementation will be successful.

DERM staff technical comments about this project may be divided into two broad categories: concerns about implementation of the Western PIR and concerns about continuing development of the Eastern PIR.

Western PIR Implementation.

1. Miami-Dade County supports implementation of this project, and appreciates both the continued support and efforts to expedite construction of this project by both the U. S. Army Corps of Engineers (USACE) and the South Florida Water Management District (SFWMD). We have some concerns, however, about project features that may not have been adequately optimized as a result of the expedited planning schedule. Operations may be changed through adaptive management, but infrastructure is unlikely to be reconfigured. We therefore offer the following comments for consideration:

a. We believe it may be possible to achieve further cost-savings by refining the sizing of Frog Pond Detention Area (FPDA) for the amount of water available to the project. Modeling results indicated that the third cell in the FPDA was not utilized. If the third cell is not needed, it may be possible to reduce or reconfigure the reservoir to efficiently utilize three cells. If a smaller total size would be adequate, the project could realize cost savings for both construction and maintenance, since an unused

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reservoir cell is likely to provide suitable habitat for invasive exotic plant and animal species such as Burma reed and Burmese pythons while providing no benefits to the project. A reduced reservoir size could also reduce the total area over which water-dependent wildlife may be exposed to residual agricultural chemicals such as copper and pesticide residues. If the currently unused capacity in the FPDA is designed to handle future increases in available water as other CERP components come on line, the Western project should consider delaying or sequencing construction of the third cell until the Eastern PIR is implemented or other CERP or non-CERP projects come on line that might provide additional water to this area. The resulting short term cost savings to this project could be redirected to improve other features and/or project monitoring.

b. We recommend that plans to plug the C-110 canal be replaced with a plan to completely backfill the canal, beginning at its southern terminus near the C-111 Canal and proceeding north at least to the intersection of the canal with theoretical SW 472 Street (aka FWC Road). Other Everglades restoration projects such as Picayune Strand and the Kissimmee River restoration have shown that plugging only partially disables the drainage function of the a canal, and full backfilling to natural grade is needed . Backfilling to theoretical SW 472 Street would separate the drainage function of the C-110 Canal from the drainage function of the C-111 by nearly two miles, and the road bed for theoretical SW 472 Street would further retard movement of water in these wetlands toward the C-111 Canal. Should the project proceed with plugging despite this recommendation, the levees on both sides of the canal should be left at least 0.5 feet above the seasonal high water level, both to preserve access for a future project to completely backfill the canal, and to prevent short-circuiting of water around the plugs during the wet season. This modest elevation may help keep the soil on the remnant levee saturated, minimizing the opportunity for invasive exotic plants to infest the area and thus minimizing land management costs until funding for full backfill can be obtained.

c. More documentation is needed to support the conclusion that the wetlands east of the FPDA in the Southern Glades Wildlife and Environmental Area (SGWEA) and Southern Glades Addition will benefit from the Western PIR project features. The continued existence of the C-111 Canal and plans to plug rather than backfill the C-110 Canal (see above comment) means that two major drainage features in the SGWEA will continue to operate, potentially limiting projected benefits as the project is actually implemented. Shortened hydroperiod in the SGWEA would affect food availability for top carnivores including wading birds and alligators, and would allow increased infestation of the region by invasive exotic plants such as Brazilian pepper, shoebutton ardisia, and Old World climbing fern. This latter effect would greatly increase land management costs for the area, which are not addressed in the project budget. As a consequence of DERM's role in acquisition and management of environmentally sensitive lands in south Miami-Dade, we are particularly concerned about these types of issues. It will, therefore, be important to detect hydrologic changes that are attributable to project operations before these changes impact restoration, mitigation, and land management projects in the area. We recommend that the monitoring plan be optimized in the lands east of the FPDA, and especially in the SGWEA and Southern Glades Addition, by crafting local scale performance measures that will allow early detection of hydrologic changes that could lead to vegetation shifts if not remediated through adaptive management. Detailed hydrology and vegetation monitoring similar to that being conducted for vegetation in the Cape Sable Seaside Sparrow Population D region should be conducted northeast of the junction between SW 424 Street and the C-111E canal, and near the junction of the C-110 and the C-111 canals to provide for early detection of potential problems.

d. We recommend further assessment of the project's effect on the degree of salt intrusion to the aquifer in the project area. We support raising trigger stages at both the S-20 structure in the Model Lands Basin and the S-18C structure in the lower Southern Glades Wildlife and Environmental Area (SGWEA) to the extent possible without causing a loss in flood protection to agricultural and urban stakeholders. Such an operational change will help combat movement of the salt intrusion line at the base of the aquifer in this region. This is especially important to Miami-Dade County because USGS has recently documented landward movement of the salt intrusion line at the base of the aquifer within the C-111 Spreader Canal project area (see attached PDF figure). The project modeling, however, revealed a potential problem area that could affect salt intrusion in the Southern Glades in spite of these anticipated trigger changes. There is a zone downstream from the S-198 structure where modeling indicated that wetland hydroperiods would be shorter than under existing conditions as a result of project implementation. Please note that this zone is coastward from the latest United States Geological Survey (USGS)

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provisional salt intrusion line at the base of the aquifer in this region. Changes in hydrology in this area could translate into further local movement of the salt intrusion line, and an increased risk for impacts to upstream municipal and private well stakeholders such as the Florida Keys Aqueduct Authority (FKAA), Everglades Labor Camp, and the cities of Florida City and Homestead. We recommend additional optimization of project infrastructure (S-198 location) and operations (S-18C and S-198 triggers) to eliminate this effect. Assuming that the S-18C trigger stages could be raised somewhat, we suggest that such impacts might be relieved if the S-198 were moved downstream toward the S-197 and S-198 operations were adjusted to maximize wetland benefits without affecting upstream flood protection. We recommend that project implementation include a delay in construction of the S-198 to allow time for this optimization to occur. We also suggest that the project monitoring plan be modified to add performance measures to address potential wetland impacts between the S-18C and the S-197 and potential changes to the location of the salt intrusion line in the SGWEA. It is essential that this area be closely monitored for hydrologic and ecological changes that could indicate adverse impacts to the salt intrusion line.

e. We recommend further assessment and monitoring of the project's effect on base flows to Manatee Bay and Barnes Sound via the C-111. These water bodies have been cut off from their historical sources of freshwater and exchange with other water bodies by various human constructs, including the Flagler Railroad at the turn of the 20th Century, followed by US 1, then construction of the C-111 Canal and Levee 31 East (L-31E) in the late 1960's. Due to the physical configuration of these basins, mixing and flushing rates are low, and they are vulnerable to both hypersalinity during drought or dry periods, and impacts from releases during extreme events. Recent modifications to the S-197 structure and operation of the C-111 Canal under the non-CERP C-111 Project have reduced damaging point source flows to Manatee Bay and Barnes Sound and replaced them with smaller, more frequent releases. These smaller releases act as base flows to the region and help moderate coastal salinities to more closely resemble estuarine patterns. Project modeling indicated that there would be a reduction in flows through the S-197, but the effect on Manatee Bay and Barnes Sound was not adequately evaluated by an appropriate hydrodynamic model or equivalent tool. We recommend that available tools, including but not limited to the Biscayne Bay TABS-MDS hydrodynamic model, USGS models, and/or salinity regression equations for the region that have been recently developed, be utilized prior to construction of this project to better evaluate the effects of this project on Manatee Bay and Barnes Sound.

f. We are concerned about water quality in two areas: the FPDA and the C-111E.

i. The FPDA has a history of agricultural use, and the project acknowledges that the soils have elevated levels of copper and other metals, plus pesticide residues. The project plans to remove the contaminated soils down to bedrock, but natural grade in this area is particularly variable and solution holes, or other features may be filled with the contaminated soil. The draft PIR states that "the situation is still being evaluated to determine whether this soil removal will adequately protect FWS trustee species". A contingency plan should be available that addresses whether and how the project will proceed and what steps will be taken to protect wildlife if complete removal of contaminated soils is either not possible through conventional means or complete removal severely impacts the functioning of the FPDA.

ii. Water in the C-111E periodically does not meet applicable state water quality standards, either for total phosphate ("Measurements at S-178, on the C-111E Canal present the highest total phosphorus (TP) concentrations (24 ppb) of any structure in the C-111 Basin (Pfeuffer, 1998a-d)") or for other contaminants of concern ("Endosulfan concentrations detected at S-178 exceeded the FDEP and the EPA water quality criterion 40 percent of the time."). This issue is not directly addressed in the draft PIR because currently the water in the secondary canal mixes with the relatively less impacted water in the C-111 prior to discharge to Everglades National Park or the coast ("Although the project involves new surface water discharges, to the FPDA, and Aerojet Canal, the source water (C-111E (sic)) is generally in compliance with state water quality standards."). If the project is successful at preventing seepage out of Taylor Slough, however, the dilution factor due to seepage will be reduced, and the proportion of water moving down the C-111 Canal that has originated in the C-111E Basin will likely increase. This raises the possibility the project could result in decreased water quality for the water moving down the C-111 Canal,

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even if numerical state water quality standards may still be met. Also, there may be potentially harmful constituents for which there are no established water quality criteria, contaminants may reside in sediments, that could be transported downstream, or concentrations of total phosphate that are higher than background could adversely affect areas outside of ENP. DERM staff recommends that water quality concerns should be evaluated not just by compliance with numerical criteria, but also by comparison to existing conditions and narrative antidegradation standards. Since we understand that there are few if any modeling tools to evaluate water quality issues, we recommend that adequate pre- and post-project monitoring be included to assist in adaptive management.

Eastern PIR Development and Initiation.

Miami-Dade County supports the Western PIR based upon an understanding that the Eastern PIR will be initiated on or before the currently scheduled date. The Recommended Plan for the Western PIR is realizing only a small proportion of the possible restoration benefits as projected by Table 5-7. Additional restoration is possible and necessary to both improve overall wildlife benefits and buffer the region against salt intrusion due to sea level rise and other water management practices. The USACE and SFWMD should consider initiating a Project Cooperation Agreement for the Eastern PIR as soon as possible. Although a Recommended Plan cannot be reasonably selected until information from the C-111 Spreader Canal Design Test has been obtained, there are several preparatory tasks that must be completed in order to proceed with Recommended Plan selection for an Eastern PIR. These tasks are best undertaken in the context of the Eastern PIR with an extended schedule that will allow for prioritization and cost sharing. Such tasks include, but are not limited to:

1. Development of an appropriate cost-effective method for generating environmentally compatible water quality downstream from the S-178 structure in the C-111E. Methods that could be tested range from simple wetland filtration areas to capture nutrients or other contaminants that adsorb on sediment particles to full-scale Stormwater Treatment Areas. The State of Florida should simultaneously commence a program to work with the stakeholders on source reduction in the watershed of the C-111E. Sufficient time must be allocated in the Eastern PIR schedule to develop and implement a test project for water quality improvement in this basin.

2. Development of an appropriate modeling tool for the project area that addresses parameters of concern to the project. The Western PIR was limited in predictive modeling capability because the available models did not address either salt transport in surface and groundwater, other water management infrastructure in the region, or tidal influence on groundwater levels in the project area. There was also no link to a downstream hydrodynamic model that would allow evaluation of benefits in the downstream estuaries. We recommend that an Eastern PIR be initiated that will contain sufficient time in the schedule for development of an appropriate set of predictive tools for this project area.

3. The wetlands of the Southern Glades and Model Lands basins are high in functional quality, and have a surface water connection to Everglades National Park, Biscayne National Park, the Card Sound Aquatic Preserve, Crocodile Lakes National Wildlife Refuge, and the Florida Keys National Marine Sanctuary. Most of these are designated by the state of Florida as Outstanding Florida Waters, and are subject to antidegradation standards. The water that is likely to be delivered to a future spreader canal will be of uncertain quality until results from Western PIR implementation are obtained. Should the Western PIR prove highly effective at reducing seepage out of Taylor Slough, water quality in the C-111 and C-111E canals could be degraded relative to the present condition, although state water quality standards might still be met. It will be important for the Eastern PIR to have the necessary monitoring data and modeling tools to evaluate and address potential effects of the future water quality in the C-111 and C-111E canals, which will be the source of water for the future spreader canal.

****

Susan M. Markley, Ph.D.

4

Miami-Dade Department of Environmental Resources Management
701 NW 1st Ct.
Miami, FL 33136
305-372-6863
****
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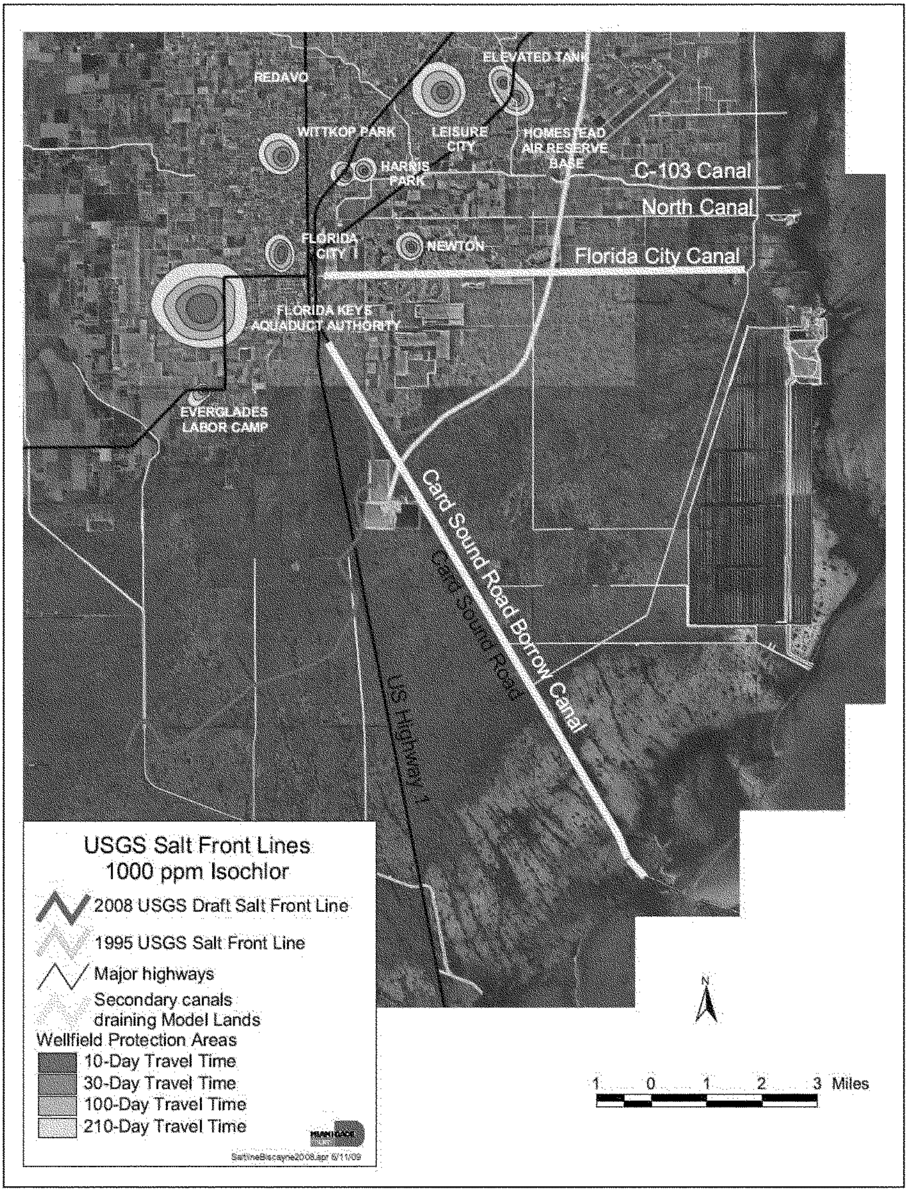
5


ELEVATED TANK
REDAVO
WITTKOP PARK
LEISURE CITY
HOMESTEAD AIR RESERVE BASE
HARRIS PARK
C-103 Canal
North Canal
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NEWTON
Florida City Canal
FLORIDA KEYS AQUADUCT AUTHORITY
EVERGLADES LABOR CAMP
Card Sound Road Borrow Canal
Card Sound Road
US Highway 1
USGS Salt Front Lines
1000 ppm Isochlor
2008 USGS Draft Salt Front Line
1995 USGS Salt Front Line
Major highways
Secondary canals draining Model Lands
Wellfield Protection Areas
10-Day Travel Time
30-Day Travel Time
100-Day Travel Time
210-Day Travel Time
N
1 0 1 2 3 Miles

Florida Department of Agriculture and Consumer Services
CHARLES H. BRONSON, Commissioner
The Capitol • Tallahassee, FL 32399-0800
www.doacs.state.fl.us

Please Respond to:
Rebecca Elliott/FDACS
CO/South Florida Water Management District
P.O. Box 24680/MSC 4410
West Palm Beach, FL 33416-4680
(561) 682-6040
relliott@sfwmd.gov

June 23, 2009

Bradley Tarr
US Army Corps of Engineers Jacksonville District
Planning Division, Environmental Branch
PO Box 4970
Jacksonville, Florida 32232-0019

RE: Public Comments - C-111 Spreader Canal Western Project Draft Integrated Project Implementation Report and Environmental Impact Statement (April 2009)

The Florida Department of Agriculture and Consumer Services (FDACS) appreciates the opportunity to provide comments on the C-111 Spreader Canal Western Project Draft Integrated Project Implementation Report (PIR) and Environmental Impact Statement (EIS) dated April 2009.

The potential for negative impacts to the privately owned agricultural properties in the vicinity of the project is our area of interest. FDACS is concerned that a rise in groundwater elevations could result in root zone flooding that will be detrimental to crops.

Of particular concern are the inconsistencies between what the growers are told in public workshops and the written information contained in the PIR. The PIR language is nothing like the assurances we have been given at public meetings. Based on the real estate criteria used to evaluate impacted lands, the PIR "allows" impacts that could be significant and adverse for agricultural stakeholders. This is not what we have been told and it is clearly not acceptable to us. PIR excerpts and additional comments are attached.

Fresh Florida.

Florida Agriculture and Forest Products
$87 Billion for Florida's Economy

As the local sponsor, the SFWMD is responsible for acquiring the private land impacted by the project. At this time, SFWMD has not identified any funds for this purpose so special care must be taken to avoid negative consequences that would accompany an increase in groundwater levels on private agricultural properties.

It is disconcerting to see the following statement on page x of the Executive Summary. "Implementation of the recommended plan or other action alternatives is expected to result in a degree of unavoidable adverse impacts. Specifically, increased hydroperiods will result in an alteration of agricultural requirements; and some existing wetlands would be permanently altered by the construction and excavation of project features. These impacts, however, would be offset by restoring and rehydrating a larger extent of freshwater and coastal wetlands." What does "alteration of agricultural requirements" mean? This area has a wide range of crop variety and crop seasonality. Cultivation includes fruit tree groves, seasonal vegetables and niche tropical and subtropical vegetables and fruits grown year round. The USACE should not consider any alternative that adds flooding risk to private agricultural property to achieve "increased hydroperiods" on public land.

Growers projected to be within the area of the project impacts are particularly concerned about the possibility of irreversible harm and unintended consequences given the project unknowns and what they've seen of court ordered interventions in other areas. Some have taken the position that if the integrity of private land interests are threatened then the project should purchase the property rather than experiment with someone's livelihood and property value.

FDACS looks forward to the restoration success of the C-111 West Spreader Canal project and the ongoing viability of agriculture in south Florida.

Thank you for the opportunity to comment on the C-111 Spreader Canal Western Project Draft Integrated Project Implementation Report and Environmental Impact Statement (April 2009). If you have questions regarding FDACS' comments, please contact Rebecca Elliott at (561) 682-6040.

Sincerely,

Rebecca Elliott
Water Policy Liaison
Florida Department of Agiculture and
Consumer Services

ec: Ray Scott, FDACS
Tom MacVicar, MFL

FDACS STAFF COMMENTS June 23, 2009: ATTACHMENT
Public Comments - C-111 Spreader Canal Western Project Draft Integrated Project Implementation Report and Environmental Impact Statement (April 2009)

1) Real Estate Takings analyses criteria Appendix D Real Estate D.13 pagers D-12 through D-14

The section below identifies 776.06 acres of private land that will be impacted by the project according to the real estate taking criteria below. This criteria "allows" wet season groundwater level increases above the 0.5 feet below ground level that could extend root zone flooding by months before a real estate taking is identified. The 776.06 acres are those that experience impacts greater than the taking criteria.

D.13 INDUCED FLOODING

Section 601(h)(5) of WRDA 2000 contains a Savings Clause that provides protection for existing legal sources of water that will be eliminated or transferred due to project implementation and for no significant and adverse reduction in the level of service for flood protection that was in existence on the date of enactment and in accordance with applicable law. Section 601(h)(5)provides:
(5) SAVINGS CLAUSE.--
(B) MAINTENANCE OF FLOOD PROTECTION.--Implementation of the Plan shall not reduce levels of service for flood protection that are--
(i) in existence on the date of enactment of this Act; and
(ii) in accordance with applicable law.

As a result of the above section, a Takings Analysis compares the condition existing in December 2000 to the conditions after construction and implementation of the Recommended Plan. After modeling was completed, an analysis was completed to determine the impacted lands for the recommended plan. The analysis compared the Existing Condition Dec 2000 to alternative2DS –wet year, dry year, average year. The team worked with the geographic information system specialists to produce a formula to be applied to alternative 2DS which would provide an initial determination of the impacted lands. After the modeling data for alternative 2DS along with the modeling data for Existing Condition Base (ECB) was provided to GIS, they used the data to create maps and data information for review by the team to determine what lands were impacted. The comparison had to account for changes in hydrology that would be significant enough that land acquisition would be required. The formula ultimately used compared the recommended plan to the Existing Base Condition. The comparison accounted for both groundwater and surface water impacts to different land classes. The real estate impacted lands for alternative 2DS was initially analyzed and computed based on the compilation of the following three criteria:

Criteria 1: Non-Agricultural Lands (40days+30 percent)
Alternative Annual Hydroperiod (at surface) is greater than 40 days longer than Existing Condition Base (ECB) run and this value is greater than 30 percent longer than ECB for any of the three years (Average year, Dry year, Wet year)

Criteria 2: Agricultural Lands for Dry Season (Any increase of Hydroperiod at-.5ft)
Alternative Dry Season Hydroperiod (at -.5ft) is greater than 5 days longer than ECB Dry Season Hydroperiod (at -.5ft) for any of the three years (Average year, Dry year, Wet year)

Criteria 3: Ag Lands for Wet Season (30days+20 percent)
Alternative Wet Season Hydroperiod (at -.5ft) is greater than 30 days longer than ECB wet season Hydroperiod (at -.5ft) AND this value is greater than 20 percent longer than ECB for any of the three years (Average year, Dry year, Wet year)

Data was then provided by GIS that showed the percentage of each individual parcel impacted and a separate data sheet for the agricultural lands, which showed the hydroperiod differences in the Dry Season and Wet Season between alternative 2DS and the Existing Condition Base for each of the years analyzed (Dry Year 1989, Average Year 1978 and Wet Year 1995). An analysis was then conducted for the agricultural lands to determine what were significant and adverse conditions warranting acquisition of a real estate interest. Any increase in any Dry Season (November through April) of over 5 days was considered as requiring acquisition of a real estate interest (Criteria 2 above). For the Wet Seasons, the increase had to meet not only Criteria 3 above, but it had to increase the entire hydro-period to greater than 80 days. Once all this data was analyzed each parcel or percentage of the parcel was reviewed to determine if only a portion (and what portion) or all of the parcel would have to be acquired. Once the analysis was complete, the information was provided to Real Estate Division to provide a cost estimate. For SFWMD owned lands, actual acquisition costs were used to the greatest extent possible.

The lands belonging to the Everglades National Park were not valued. The lands in the Frog Pond area were approved for acquisition under the C-111 South Dade Project in the 1994 General Design Memorandum and will be provided as an item of local cooperation under that project. Therefore the real estate cost for lands required for each Alternative within the Frog Pond were not included under the C-111 Spreader Canal Project real estate costs.

Page 2 of 4

Total impacted lands were determined to be approximately 11,564.65 acres for Alternative 2D Short. SFWMD owns approximately 9,687.53 acres within the impacted lands in Alternative 2D Short. The SFWMD owned lands were valued using actual acquisition and actual SFWMD administrative costs. Miami-Dade County owns approximately 131.06 acres within the impacted lands. The State of Florida owns approximately 15 acres and Florida Power & Light owns approximately 955 acres. The remaining 776.06 acres of land are all privately owned.

2) PIR paragraph Executive summary page xiii describing SFWMD Funding

The excerpt below describes funding that is not currently part of the SFWMD planning process The 776 acres of private land represent ~ $ 30,000,000 of real estate cost in the ~ $ 48,000,000 projected real estate cost in the PIR.

"Regarding the level of service for flood protection, project modeling indicated that approximately 11,565 acres of land could be impacted by the operation of the project. The SFWMD has agreed to acquire in fee privately owned lands, totaling 776 acres, which are determined to be, or to have been, impacted by operation of the project."

3) Unavoidable Adverse Impacts to Agriculture Issue

The premise of the excerpt below is not acceptable to agricultural stakeholders that will be impacted by the project. During meetings with SFWMD and USACE staff, growers have been assured that no such impacts will be occurring to their private lands, crops, and livelihood.

Section 7 – page 7-31

7.23 UNAVOIDABLE ADVERSE IMPACTS

7.23.1 Land Use

Existing production of ornamental trees, nursery crops, and commodity row crops (i.e., peanuts, corn, citrus) would be permanently altered in areas subject to freshwater rehydration and increased hydroperiods unsuitable for agricultural requirements.

4) Cumulative Impacts to Agriculture

The "permanently removing existing acres from agricultural production" in the excerpt below should not be occurring due to the C-111 West Spreader Canal project as currently represented to agricultural land owners in the vicinity of the project.

Section 7 -32 2nd paragraph– page 7

7.25 CUMULATIVE EFFECTS
Cumulative impact is the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7)."
The C-111 SC Western project features are designed to enhance or restore wetland habitat functions by distributing freshwater flows through Taylor Slough into freshwater wetlands and downstream estuaries adjoining Florida Bay to provide a more natural and historic overland flow through existing coastal wetlands. This project along with other CERP projects would cause some adverse consequences to agricultural land use, permanently removing existing acres from agricultural production. These impacts may be felt locally and/or regionally as the economic base derived from agriculture is incrementally reduced relative to other sectors of the economy.

5) Executive Summary Unresolved Issues – page xv

The excerpt below indicates that there are no unresolved private interest issues. Based on items 1, 2, 3 and 4 above this should be revisited.

"UNRESOLVED ISSUES
There are no significant, unresolved issues that have been presented by stakeholders, public or private interests. The project will not result in a reduction in the quantity of water available to meet demands for water supply. Effects on adjacent lands have been evaluated as part of the level of service of flood protection analysis."

Page 4 of 4

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

June 22, 2009

Colonel Paul Grosskruger
Commander
United States Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Colonel Grosskruger:

Thank you for the opportunity to review and provide comments on the *Draft Project Implementation Report and Draft Environmental Impact Statement (DPIR/DEIS) for the C-111 Spreader Canal Western Project* dated June 2009. The Department of the Interior (Department) appreciates the efforts of your staff in producing the DPIR/DEIS. As stated in the DPIR/DEIS, the C-111 Spreader Canal (SC) Project, a priority for the Department, has been split into two separate, but related projects: the C-111 SC Western Project and the C-111 SC Eastern Project. The first project, the C-111 SC Western project primarily concentrates on improving freshwater flows to Florida Bay via Taylor Slough, which we believe is critical to the long term health and viability of Florida Bay. The Department appreciates the inclusion of these features. The second project will be the C-111 SC Eastern project that will mainly concentrate on environmental restoration in the Southern Glades and Model Lands. The Department supports the Recommended Plan for the C-111 SC Western Project and moving ahead as soon as possible with the C-111 SC Eastern Project.

Overdrainage associated with diversion of water away from the southern Everglades as well as the overdrainage created by the existing C-111 conveyance system has detrimentally impacted the hydrology of Taylor Slough in Everglades National Park, the South Dade Wetlands, and the adjacent coastal ecosystems including Biscayne National Park. The Department recognizes that this project will not attempt to restore water quantity, which is required for restoration, but does address improving the distribution and retention of existing water in the project area.

The Recommended Plan, Alternative 2DS, includes the following features:

- Frog Pond Detention Area;
- Aerojet Canal;
- One new operable structure in the lower C-111 Canal;
- Incremental Operational changes at S-18C;
- One plug at S-20A;
- Operational changes at existing structure S-20; and
- Ten plugs in the C-110 Canal.

Alternative 2DS will provide improvements in the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough by establishing a hydraulic ridge between Taylor Slough and the C-111 Canal to prevent or reduce seepage losses from Taylor Slough and its headwaters. The hydraulic ridge will be established by the diversion of water from the C-111 Canal to the existing Aerojet Canal and an above ground detention area to be constructed on Frog Pond lands. Marsh stage triggers in Taylor Slough and the adjacent wetlands will be used to manage pumping rates into the Frog Pond Detention Area and the Aerojet Canal. Two additional features will be implemented in Alternative 2DS to promote additional groundwater mounding south of the Frog Pond lands and Aerojet Canal. The two features include the construction of one new operable structure in the lower C-111 Canal and incremental changes at structure S-18C. The Recommended Plan is also intended to improve wetland hydroperiods and hydropatterns in the Southern Glades and Model Lands. This will largely be accomplished by modifications to current operations at structure S-20, the installation of an earthen plug in the L-31E Canal near S-20A, and the installation of two earthen plugs in the C-110 Canal.

The Department is in agreement that an intensive Operational and Monitoring Plan (OMP) is necessary. The OMP and Incremental Adaptive Restoration (IAR) should allow for optimization of the Recommended Plan while presenting learning opportunities to fully maximize environmental benefits and answer any decision critical uncertainties for the future C-111 SC Eastern project. It is recognized that IAR will be important in refining project operations and features. The DPIR/DEIS should include a well-defined description of how adaptive management and IAR proposals will be developed and implemented to meet project objectives. Monitoring should also be utilized to aid in addressing any water quality concerns. The Department understands that the Spreader Canal Design test for the C-111 SC Eastern Project will be implemented under the CERP Engineering and Design Agreement, and that it will serve to eliminate the uncertainties related to the construction and operation of a spreader canal, including any water quality concerns within the vicinity of the proposed test.

The Draft Project Operating Manual (DPOM) contained in the DPIR/DEIS needs refinement. In order to maximize restoration opportunities, the Recommended Plan includes incremental operational changes in the current "open and close" triggers at the existing structure S-18C. The DPIR/DEIS states that the "open and close" triggers will be increased in increments of no more than 0.1 feet per year and the total change in each trigger shall not exceed 0.4 feet. Increased stage triggers for opening structures at S-177 and S-18C provide significant project benefits and are important to the Department. The DPOM in the DPIR/DEIS should clearly articulate the foregoing and state how this will be accomplished operationally. The C-111 canal stage is also a critical issue as the lowering of operational canal stages on the eastern border of Everglades National Park is associated with increased seepage out of the Park, and with potentially detrimental drydowns within the Park and the South Dade wetlands; it is important that this project not result in any reductions in the C-111 canal stage. The DPOM should contain a narrative to that effect.

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Further general and specific recommendations are contained in the attached General Comments and Additional Technical comments supplied by Everglades & Biscayne National Parks. The Department looks forward to working with your staff as you move forward to finalize the DPIR/DEIS and implement this important project.

Sincerely,

Donald Jodrey
Attorney-Advisor
Department of the Interior

Attachments

General Comments
Everglades & Biscayne National Parks
National Park Service
June 11, 2009

Draft Project Implementation Report: C-111 Spreader Canal,
Western Phase 1 Project

Thank you for the opportunity to review and comment on the Draft Project Implementation Report (DPIR) prepared for the C-111 Spreader Canal (C-111 SC), Western Phase 1 Project. We appreciate all of the time and the substantial efforts the US Army Corps of Engineers has spent preparing the DPIR, which consolidates the efforts that the Project Delivery Team (PDT) has made since it was formed in 2001.

It has been recognized that the ecological health of Taylor Slough in Everglades National Park, the South Dade Wetlands, and the adjacent coastal ecosystems including Biscayne National Park, have been in decline from the altered hydrology resulting from regional water management policies and operations. Over 150,000 acres of freshwater wetlands are affected, and some 130,000 acres of nearshore estuarine and bay areas have been impacted. This project seeks to partially address these impacts with improvements to hydropatterns in Taylor Slough and westerns portions of the South Dade Wetlands. We note that most of these impacts are from overdrainage associated with diversion of water away from the southern Everglades, as well as the drainage imposed by the C-111 conveyance system. This project will not attempt to restore water quantity, which is required for restoration, but addresses improving the distribution and retention of existing water in the project area. Restoration of adjacent coastal ecosystems (e.g., in Biscayne National Park) will require the delivery of additional water from the regional system.

Comments on the DPIR

- NPS finds the DPIR thorough and concise, providing the general framework from which the currently recommended project configuration was developed. NPS appreciates the opportunity to participate in the (PDT) formulation process and the consideration provided to it regarding resolution of flow distribution issues raised during the process. The recommended plan, Alternative 2DS, should provide seepage management benefits for Taylor Slough, the estuaries, and the Southern Glades by reducing drainage impacts in the lower L31E and C-111 canal systems.

- The principle of extending seepage management for Taylor Slough southward is sound, and fits well within the context of the multiple projects currently in progress or proposed to restore the southern Everglades and the eastern areas of Everglades National Park.

- As described in the DPIR, it is important that canal conveyance be eliminated or greatly reduced to improve hydropatterns in the project area. NPS agrees with this and considers it an important means of achieving project benefits. The proposed plug in the C-111 canal (above S197) and those in the C-110 canal should assist in improving hydropatterns in Everglades National Park, and the Southern Glades, respectively. The plugs and proposed stage increases in L31E (at S20A, S20) should provide some hydrologic benefit to areas bordering Biscayne National Park.

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- Water quality has been and will continue to be an issue that merits attention. Undesirable changes in Taylor Slough associated with phosphorus enrichment have been noted adjacent to recently constructed seepage management features. These changes infer that canal water detention may contribute additional nutrients through ground water or surface water exchange. Similar water detention areas proposed by this project thus carry the risk of similar water quality impacts to NPS lands. In addition, lands proposed for use as water detention areas carry the contaminant legacy of intensive agriculture. Agrichemical residuals on these lands pose a risk to fish and wildlife resources in area, and should be effectively and thoroughly mitigated before incorporating them into the project.

- The benefits and impact analyses within the C-111 SC PIR 1 remain largely uncertain since all of the analyses are based on limited modeling. It is clear, therefore, that Incremental Adaptive Restoration will be important in refining project operations and features. The DPIR should include a well-defined description of how the effects of the C-111 SC Project will be evaluated, and how adaptive management proposals will be developed and implemented to meet project objectives.

- Hydrologic modeling results indicate that increases in stage criteria for opening structures S-177, and S-18C provide significant project benefits. The operations plan in the DPIR does not clearly articulate how this will be accomplished. Without increased stage triggers at these structures, the project may produce few ecological benefits.

Recommendations

- NPS concurs with the DPIR that implementation of sound monitoring and adaptive management plans are critical to the success of the project. These plans should include:

  - Surface water and groundwater monitoring that addresses potential contaminants of concern such as nutrients, pesticides, and metals within Taylor Slough and the Southern Glades wetlands.
  - Nutrient enrichment bioassessment monitoring at the Frog Pond Detention area and transects that extend into the Taylor Slough marsh.
  - Fish bioaccumulation monitoring for pesticides and metals for native fish at the existing Taylor Slough monitoring stations.

- Consideration should be given to extending the Frog Pond detention feature should be extended northward to connect fully with the existing C-111 detention area complex, so that better control of seepage from Taylor Slough can be accomplished. Any gaps in the seepage control system may compromise the benefits expected from a more natural hydroperiod in Taylor Slough.

- While backfilling the canals is the most effective means and is thus most desirable, the recommended plan (Alternative 2DS) calls for partial filling or plugs as a cost-effective way to reduce conveyance. The NPS recommends that the plugging of the C111 SC Western Phase 1 project be fully integrated, in design and scheduled implementation, with the plugging in the C111 South Dade project. To better accomplish C111 SC project objectives, NPS recommends plugs at several additional sites:

  - The L-31W must be backfilled and/or adequately plugged to ensure the C-111 SC detention areas function properly. For the Aerojet feature to be fully functional, the drainage imposed by the L-31W must be stopped.

- The Aerojet Canal system currently has an east-west feeder canal that will compromise the effectiveness of the recommended project plan. NPS recommends that this canal be plugged in coordination with the South Dade and C-111 SC projects to prevent groundwater losses eastward from the Aerojet feature.
- NPS recommends that an additional plug be installed in the L31E, as it will provide additional benefit with low cost.
- Within the project, overdrainage of the Model Lands by the Card Sound Road canal could also be reduced at relatively low cost. NPS recommends that plugs be installed in this canal, one north and one south of its junction with L31E, as part of the recommended project.

➢ NPS considers C-111 canal stage a critical issue, since it controls wetland hydroperiods and thus the well-being of Taylor Slough and downstream Florida Bay. Lowering of operational canal stages on the eastern border of Everglades National Park is associated with increased seepage out of the Park, and with potentially detrimental drydowns within the Park and the South Dade Wetlands. This project should not result in any reductions in canal stage.

➢ The effect of seepage losses from Everglades National Park is felt most strongly during the dry season, when marshes dry out early in the season. Additionally, seasonal lowering of the water table affects Biscayne National Park resources. Reducing wet season canal seepage from Everglades National Park, the Southern Glades and Model Lands, and operating the system to extend marsh hydroperiods in the entire project area into the dry season, should provide project benefits to both Parks.

Additional Technical Comments on the Draft PIR for the C111 Spreader Canal Western Phase 1 Project

Everglades & Biscayne National Park
National Park Service

1. We have the following comments to the Water Quality section found in the C-111 SC DPIR Appendix C:

    - We suggest using the full period of record for all data utilized in the water quality analyses.

    - This section states that within the C-111 basin, "insecticides and herbicides are sporadically found above detection limits in both surface and groundwater". This statement needs to be revised since endosulfan surface water concentrations recorded at the S-178 monitoring station exceeded the chronic (0.056 ug/L) water quality criterion 42% of the time and exceeded the acute criterion (0.22 ug/L) 14% of the time during the 1987-2008 timeframe. Statistical trend analyses at S-178 show that endosulfan concentrations have not changed or are increasing in surface water and sediments, respectively.

    - This section states that atmospheric mercury loading was found to be more important than surface water loading. This is inconsistent with most scientific studies that attribute most mercury loading to atmospheric sources.

2. The Contaminated Soils section in the C-111 SC DPIR Appendix A describes how soils from the new Frog Pond Detention Area will be used on-site for construction of berms, levies, or roads. We suggest describing the methodologies that will ensure any reused contaminated soils will meet all required leachability criteria and will not pose a long-term threat to natural resources and water quality.

3. Description of the ecological benefits in the DPIR should be tempered by knowledge of the limitations of the model used in project design. While one of the strongest capabilities of the MODBRANCH modeling is in overall water budgets, overland flow values through the marsh are one of the weakest. Ecological performance measures that are built on the weakest parts of the model are an uncertain foundation for evaluating project benefits. We recommend that language describing benefits to the marsh, to essential fish habitat and seagrasses, be accompanied by a description of the model weaknesses. Any additional, non-model based technical information that provides evidence for benefits or impacts of the project should be included and highlighted.

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4. NPS concurs with the recommendation by the US Fish and Wildlife Service that further characterization of soil contaminants in the new Frog Pond Detention Area is needed to ensure mitigation efforts will reduce soil contaminant levels below risk-based benchmarks for natural resources. In particular, the C-111 SC DPIR states that there will be no adverse effects to the Everglades snail kite, while the 2009 New Fields study indicates that following the proposed soil scraping remediation in the new Frog Pond Detention Area, copper soil levels will still exceed the risk-based benchmark for this species. Further evaluation of potential project effects, via contamination levels, to the Everglades snail kite is warranted.

5. As the features of the next phase of C-111 SC are designed, water quality treatment features for nutrients and the contaminants of concern should have a high priority. As part of the water quality mitigation efforts, implementation of an ongoing BMP program with the agriculture community is essential to reduce agrichemical contaminant sources to soils, surface waters, and groundwater in the Taylor Slough, C-111 basin, Panhandle wetlands, and ultimately, Florida Bay.

6. In designing canal plugging and backfilling, reduction of source pools of exotic fish should be considered. In addition to plugs, canals adjacent to Everglades National Park should be shallowed sufficiently to reduce their potential as a source of exotic fish invasions into the Park.

*****

AUDUBON OF FLORIDA
EVERGLADES FOUNDATION
NATIONAL PARKS CONSERVATION ASSOCIATION
NATURAL RESOURCES DEFENSE COUNCIL
SIERRA CLUB, MIAMI GROUP
TROPICAL AUDUBON SOCIETY
WORLD WILDLIFE FUND

June 23, 2009

Brad Tarr
Planning Division, Environmental Branch
U.S. Army Corps of Engineers, Jacksonville District
P.O. Box 4970
Jacksonville, FL, 32232-0019

<*Sent via email to* C111SCComments@evergladesplan.org>

Dear Mr. Tarr,

The following undersigned organizations have long looked forward to on-the-ground progress on the C-111 Spreader Canal (SC) project. The Western component of this project provides the most immediate opportunity to reduce the devastating impact to Everglades National Park caused by the diversion of water from Taylor Slough toward the massive C-111 canal. We submit this letter in response to the Draft Integrated Draft Project Implementation Report (DPIR) and Draft Environmental Impact Statement (DEIS) for the C-111 Spreader Canal Western Project (Western Project).

Florida Bay continues to suffer symptoms of ecological decline, exhibited by prolonged periods of hypersaline conditions in the imbedded lakes region, expansive algal blooms, and two seasons of the lowest numbers of nesting roseate spoonbills since the 1960s. Although the C-111 SC project is split into two phases, we have reviewed the 90% Detailed Design Report for the Western Project and believe the features of Alternative 2DS, if operated sufficiently, are capable of restoring more normal freshwater flow patterns and volumes to Taylor Slough and Florida Bay. Further restoration in the project area is required, however, and we emphasize the need to begin planning with the utmost speed for the Eastern Project, another critical Comprehensive Everglades Restoration Plan (CERP) project.

The Water Resources Development Act of 2000 ("WRDA 2000") requires the identification – in terms of quantity, timing and distribution – of water a CERP project makes available for the natural system. The DPIR discusses and details the required analyses in Annex C, and notes its compliance with WRDA 2000 in the main portion of the document at page 8-19. The executive summary, however, suggests (at page xiii), contrary to the detailed identification of water in Annex C, that no identification of water was completed for the project because the project only "redistributes water." We are confused by this inconsistency and respectfully request that the U.S. Army Corps of Engineers correct the executive summary to reflect the work identifying the water the project makes available included in Annex C. We note that, as a practical matter, all CERP projects seek at root to redistribute water in the greater Everglades ecosystem; the restoration challenge is that redistribution of water – from wet season to dry season, and from areas of the Everglades that are too wet to those that are too dry (as a result of drainage, development, and agriculture). Quantifying and protecting those changes in quantity, *timing* and *distribution* is precisely what WRDA 2000 requires by way of its assurances provisions (and is what was done in Annex C).

The extent of ecological lift generated by this project, which will result from redistributing flows towards Taylor Slough, is entirely dependent on project operations. While there are several potential constraints identified in the DPIR, we expect that any constraints which act to diminish the ecological restoration provided by the project will be actively addressed and overcome. We understand the learning provided by the Western Project, namely relationships between flow volumes and ecological responses, will be used to guide planning efforts for the Eastern Project. However, the Western Project must also exhibit an ecological response on its own. In other words, we must accomplish a certain degree of restoration with the first phase of the project. Otherwise, we not only jeopardize learning critical information needed for the second phase, we also allow ecological decline in Florida Bay and Taylor Slough wetlands to continue on its current course.

In order to achieve an ecosystem response necessary to guide the planning for the Eastern Project, implementation of Western Project must produce freshwater flows that will significantly increase the salinity buffering capacity in the Northeastern Basin of Florida Bay. Some measures of success include less saline conditions at the Everglades National Park Taylor River hydrological monitoring platform and at the mouth of Little Madeira Bay. A reduction of salinity in the ecotonal wetlands will begin to reverse the current trends of long periods of saline intrusion and shortened hydroperiods and give way to a more productive and diverse assemblage of submerged aquatic vegetation (SAV), particularly an increase in coverage of fresh to brackish water species such as *Ruppia maritima*, *Chara hornemanii* and *Utricularia spp.* Aptly named, vast expanses of widgeon grass (*Ruppia maritima*) used to cover the submerged bottom habitat of the imbedded mangrove lakes and attract thousands of waterfowl, such as blue-winged teals and American coots, that formerly spent their winters in the southern Everglades. A transition back towards more historical salinity conditions in these imbedded lakes will promote the return of the grass species that used to provide winter forage for large numbers of waterfowl. Additionally, a more robust SAV population and more frequent periods of freshwater dominance across the ecotonal wetlands will result in an increase in the prey-based freshwater fish community and thus the productivity of the region. Ultimately, reducing the damaging influence of the C-111 canal by the implementation of the Western Project will produce a response in a key Florida Bay indicator species: the roseate spoonbill. Successful project operation will increase the rate and success of

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nesting in the northeastern Florida Bay colonies, which are most influenced by the disruption caused by the C-111 canal.

Figure D-8 illustrates the direct relationship between increasing water stages at S-18C and the corresponding increase in percentage flows to Taylor Slough. The Western Project proposes incremental operational changes in the current "open and close" triggers at S-18C, and all project modeling presented at the 2008 stakeholder workshops predicted the largest ecological lift will occur with increasing stages at this structure. The ecological benefits described in the DPIR are predicated on a 0.4 foot increase in operating stages at S-18C. We note that while a tentative schedule to raise canal levels at S-18C is identified in Figure D-10, the text describes that such raises will take place "pending the successful outcome" of the initial effort to raise canal stages and fully evaluate the range of climatic conditions and water level responses within the basin. Because raising stages at S-18C is such a critical component of project success, we are concerned that no criteria have been determined by which the increase in stages will actually proceed should we reach "backstop" and levels are lowered to prevent flooding impacts. For example, what would be the course of action if after year three of project operations, it was determined that raising levels beyond 0.2 foot causes adverse impacts? When would an increase to 0.2 foot be attempted again?

The Draft Project Operating Manual, as it is currently written, does not answer such questions. It states that deviations in planned operations of the S-18C structure could be immediately implemented to lower water control levels as recommended by the operating staff or based on real time monitoring data indicating the risk of flooding has increased beyond an acceptable level. The manual further describes that prior operations would then be "reinstated later when conditions appear more favorable". We note that there is not a clear definition of "later" or "more favorable conditions". These terms could likely mean different things in different situations, however, we stress that a return to the prescribed operating goals (Figure D-10) is essential to deliver the volumes of flows needed to spur an ecological response. If "more favorable conditions" never materialize, there is no plan outlined in the Draft Operating Manual directing next steps; there is no guarantee that "later" will ever come or that stages will be raised again.

In short, we believe that the benefits identified for the natural system in the DPIR depend on certain operational stages at S-18C, and that the operational manual must clearly outline whether, and under what circumstances, those stages (and attendant benefits) may be achieved. WRDA 2000 § 601(h)(4)(C)(i) and 33 CFR § 385.28 require that project operating manuals be consistent with reservations or allocations of water for the natural system as described in PIRs, and reflect the operational criteria used in the identification of the appropriate quantity, timing and distribution of water dedicated and managed for the natural system. That is, given that the project benefits described in the DPIR are based on a 0.4 foot stage increase at S-18C, the PIR must outline criteria by which to proceed with again raising levels if the schedule included in the DPIR for achieving 0.4 foot stage is (temporarily) derailed because the determination is made that flooding risks have increased to an "unacceptable level". Moreover, the South Florida Water Management District has committed to operating the Western Project in an incrementally adaptive manner, so project operation constraints must be overcome and Taylor Slough flows increased until the ecosystem responds.

We understand the necessity of installing water level monitoring in agricultural lands and observing water levels in the root zones, as these will document the impact of the project on private lands. However, we would object to using root zones to define the "levels of service for flood protection" bestowed on lands from the Central and Southern Florida (C & SF) Project. See WRDA 2000 Sec. 601(h)(5)(B). The C & SF Project was designed to provide a level of service resulting from the design storm, and reflects the performance of the entire basin. A root zone, on the other hand, is specific to a given parcel, and is largely affected by local topography and crop type. Therefore, the root zone metric needs to be completely compatible with the actual benefit provided by the C & SF Project, and not the benefit that is desired or would need to be provided to produce a given crop on a specific parcel.

Again, it is critical this project accomplish both the maximum learning possible and true environmental benefits. Identifying potential areas prone to adverse impacts and proactively eliminating or reducing the extent of impacts will help the project better accomplish its goals (and accomplish them faster). Applying such strategies so that there are criteria included in the operational plan, with a commitment to expand upon them as needed to operate the project to achieve environmental benefits, is absolutely necessary. Also, while water quality issues are not expected to be a project constraint, copper concentrations found in the Frog Pond Detention Area are above levels that could cause adverse effects to wildlife. Likewise, high nutrient and pesticide levels in the C-111 E canal are well known. If any water quality issues prove problematic to the project, we expect the design of the second phase will address any problems.

We again note the importance of the next phase of this project. The DPIR states that any negative effects that may occur as a result of implementing this project (such as drawdown effects in the central portion of the project area) that cannot be rectified through adaptive management will be addressed in the Eastern Project. Therefore, it is imperative that planning for the Eastern Project proceed expeditiously. The Eastern Project is likely the key to truly restoring Florida Bay, as well as bringing long delayed ecological benefits to the Southern Glades and Model Lands wetlands, Manatee Bay and Barnes Sound. Salt water intrusion is a serious threat in both the C-111 and Biscayne Bay Coastal Wetlands (BBCW) basins, and the completion of both the C-111 SC and BBCW CERP projects is critical to preventing continued saltwater movement inland. Rising sea levels associated with climate change will further exacerbate this situation, so the re-establishment of more natural freshwater flow (both volumes and entry points) into the southern estuaries will help buffer not only the ecosystem, but also agricultural lands and urban water supply wells.

Finally, in sum, we ask that 1) the language in the executive summary be made consistent with Annex C and with WRDA 2000 ("which requires the identification of the quantity, timing, and distribution, of water for the natural system), 2) the criteria and timetable that allow S-18C to be operated to provide the benefits described in the PIR be clearly outlined 3) this project utilize the monitoring provisions that allow for identification of potential flooding and water quality problems, and subsequently address those problems not solved in the Western Project in the Eastern Project PIR, and 4) planning and implementation of the Eastern Project, including the removal of the lower C-111 canal, begin expeditiously thereby restoring Florida Bay, Biscayne Bay, and the south Dade wetlands.

We strongly support the expeditious implementation of this project and expect that its operations will deliver sufficient flows via Taylor Slough to Florida Bay and generate an ecological response. We appreciate the consideration of our comments and look forward to reviewing the Final PIR/EIS.

Sincerely,

<Signatures waived to expedite delivery>

Jerry Lorenz
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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

PROJ 29.02.12

VIA FEDERAL EXPRESS

June 30, 2009

Ms. Erin Steurer
CERP Permit Lead and 1501 Coordinator
Restoration Planning and Permitting Section
Florida Department of Environmental Protection
2600 Blair Stone Road, MS 3560
Tallahassee, FL 32399

Dear Ms. Steurer:

Subject: Final State Compliance Report
C-111 Spreader Canal Western Project
Comprehensive Everglades Restoration Plan Project

As you requested, enclosed for your review are twelve paper copies and one CD of the Final State Compliance Report for the above referenced Comprehensive Everglades Restoration Plan project.

We are submitting this Final State Compliance Report for formal review and approval at this time. We hope to have the Florida Department of Environmental Protection approval before August 31, 2009. We appreciate FDEP's cooperation on this project, and look forward to working with staff in the future.

Should you have any questions, please call me at (561) 681-2563 extension 3709 or via email aperez@sfwmd.gov.

Sincerely,

Alex Perez

Alex Perez, P.E., P.M.P.
Principal Engineer
Everglades Restoration Planning Department
Everglades Restoration Resource Area

AP/pv
Enclosures: 13 (12 copies & 1 CD)

c: Michael Collis, USACE
John Shaffer, SFWMD

3301 Gun Club Road, West Palm Beach, Florida 33406 • (561) 686-8800 • FL WATS 1-800-432-2045
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Ms. Erin Steurer
June 30, 2009
Page 2

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Pp-E

FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Ms. Rebecca Griffith
Jacksonville Planning Division
Jacksonville USACE
P.O. Box 4970
Jacksonville, Florida 32232-0019

July 23, 2009

Re: DHR Project File No. 2009-02325/ Received by DHR: April 30, 2009
Central and Southern Florida Project – Comprehensive Everglades Restoration Plan
C-111 Spreader Canal Western Project
Draft Integrated Project Implementation Report and Environmental Impact Statement
US Army Corps of Engineers – Jacksonville District / South Florida Water Management District

Dear Ms. Griffith,

Our office reviewed the referenced projects for possible impact to historic properties listed, or eligible for listing, in the National Register of Historic Places. The review was conducted in accordance with Section 106 of the National Historic Preservation Act of 1966 as amended, and 36 CFR Part 800: Protection of Historic Properties; and the National Environmental Policy Act of 1969, as amended and the implementing state regulations.

Our review of the documents indicates that the draft Integrated Project Implementation Report and Environmental Impact Statement adequately address the unexpected impact to cultural resources in the project area of potential effect per assessments that were conducted and consultation with this office over the past year or more.

If you have any questions concerning our comments, please contact Michael Hart, Historic Sites Specialist, by phone at (850) 245-6333, or by electronic mail at mrhart@dos.state.fl.us. Your continued interest in protecting Florida's historic properties is appreciated.

Sincerely,

Laura A. Kammerer

Laura A. Kammerer
Deputy State Historic Preservation Officer
For Review and Compliance

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

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United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, DC 20240

AUG 06 2009

Colonel Alfred A. Pantano, Jr.
Commander
United States Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, FL 32232-0019

Dear Colonel Pantano:

Thank you for the opportunity to review the *Final Project Implementation Report and Environmental Impact Statement (PIR/EIS) for the C-111 Spreader Canal Western Project* (C-111 SC Western Project) dated July 2009.

The Department of the Interior (Department) supports the Recommended Plan for the C-111 SC Western Project. The C-111 SC Western project, a priority for the Department, primarily concentrates on improving freshwater flows to Florida Bay via Taylor Slough, which we believe is critical to the long term health and viability of Florida Bay. We look forward to working with your staff as you move ahead with project design, in particular, any feature involving the discharge of nutrients from the surrounding agricultural farms and the fish farm, water quality monitoring, and development of the operational regime for the project. Our comment letter, dated June 22, 2009, on the *Draft Project Implementation Report and Draft Environmental Impact Statement for the C-111 Spreader Canal Western Project* is attached.

The second project will be the C-111 SC Eastern project that will mainly concentrate on environmental restoration in the Southern Glades and Model Lands. The Department also supports moving ahead as soon as possible with the C-111 SC Eastern Project.

Sincerely,

Donald Jodrey
Attorney-Advisor
U.S. Department of the Interior

Attachment

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

August 12, 2009

Ms. Alisa Zarbo
U.S. Army Corps of Engineers
Jacksonville District
Regulatory Division
Palm Beach Gardens Regulatory Office
4400 PGA Boulevard / Suite 500
Palm Beach Gardens, FL 33410

Subject: EPA Review of the COE's "C-111 Spreader Canal Western Project Final Project Implementation Report and Environmental Impact Statement"; Everglades and Florida Bay; CEQ# 20090243; ERP# COE-E39078-FL

Dear Ms. Zarbo:

Pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Army Corps of Engineers' (COE) Final Environmental Impact Statement (FEIS) for the subject C-111 Spreader Canal (C-111 SC) Western Project. This Comprehensive Everglades Restoration Plan (CERP) project sponsored by the South Florida Water Management District (SFWMD) has changed from its original Restudy design and was divided into a Western and Eastern Project. The present Western Project primarily addresses changes in western flows through Taylor Slough to restore wetlands and to moderate/stabilize salinities in Florida Bay. The prospective Eastern Project is to cover the remaining project area and ultimately include the backfilling of the C-111 Canal. EPA has previously provided comments on the Draft EIS (DEIS) in a letter dated June 8, 2009.

As was the case with the DEIS, EPA has concurrently received a copy of the Final Environmental Assessment (FEA) on the "C-111 Spreader Canal Design Test", which will serve as a pilot study for the design of the Eastern Project. The Spreader Canal feature will not be implemented under the current C-111 SC Western Project but is expected to be a major component of the overall project. We continue to support such pilot studies and will defer to the COE on this demonstration without formal comment. However, we assume that the FEA is consistent with the objectives of the present FEIS and improves water quantity and quality in the project area.

We appreciate the COE's responses to our comments on the DEIS. These responses are found on page B-105 of Annex B in Volume 3, and a copy of our letter was provided on page B-57. We have concentrated our FEIS review on those responses. We offer the following final comments in support of the C-111 SC Western Project:

o EPA-1 (*Water Quality*) – We appreciate the water quality improvements to Section 7.8.2 and in the discussion of Alternative 2DShort regarding the expected water quality improvements due to the project. However, it is unclear why the 'EPA-1' response states that "…the project is not targeting water quality improvement…", given that a major component of CERP is the water quality improvement of the Everglades – not just water quantity improvements (rehydration) – in the overall restoration of the Everglades. All CERP projects should therefore have a water quality component or that benefits water quality at some capacity.

o EPA-3 (*Monitoring Plan*) – We find the Project Monitoring Plan in the FEIS to be responsive to our comments on the DEIS.

o EPA-4 (*Environmental Justice: EJ*) – We are pleased to understand from this response that no public EJ issues were raised at a recent public meeting or determined. We note from Section 5.6.4.2 that a stakeholders meeting took place in 2003. However, we also note that Section 5.6.4.2 in the DEIS was not modified in the FEIS. It is therefore unclear if these stakeholders included or represented potentially affected EJ groups (what public outreach was used to assemble stakeholders?), and if conditions have changed since 2003.

o EPA-6 (*Invasive Species*) – Although reduction and control of invasive species in the project areas to be rehydrated is not required, it would benefit the overall CERP goal of Everglades restoration. Such restoration should emphasize native wetland species as opposed to invasives.

o EPA-7 (*Cumulative Effects*) – The *Cumulative Effects* section (7.25: pg. 7-32) is much improved due to its disclosure of related CERP projects that indirectly affect the C-111 SC Western Project. Section 7.25.2 would have benefitted by inclusion of the relative merits of the present Western Project versus the proposed Eastern Project.

In summary, EPA continues to support the C-111 SC Western Project. We believe that this project and its proposed Eastern Project counterpart should benefit the CERP recovery of the Everglades and Florida Bay. We therefore recommend that implementation be expedited.

We appreciate the opportunity to review the FEIS. Should you have questions regarding these comments, feel free to contact Chris Hoberg of my staff for NEPA issues (404-562-9619 or hoberg.chris@epa.gov) and Eric Hughes of the EPA Water Protection Division (located in the Jacksonville District office) for technical issues (904/232-2464 or hughes.eric@epa.gov).

Sincerely,

Heinz J. Mueller, Chief
NEPA Program Office

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B.4.2 Public and Agency Comments and Responses on the Draft Report

TABLE B-3: PUBLIC AND AGENCY COMMENTS, AND RESPONSES ON THE DRAFT REPORT

C-111 Spreader Canal Western Project Comment Response Matrix				
Comment Number	**Organization / Agency**	**Date Received**	**Comment**	**Response**
EPA-1	United States Environmental Protection Agency	8-June-09	EPA requests further FEIS discussion pertaining to water quality benefits provided directly by the project or indirectly (e.g., sponsor land acquisition-removal from farming and potential development)	The water quality discussion in Section 7.8.2 includes a statement noting that the change in land use will result in improved water quality conditions. The same statement has been added to the discussion for Alternative 2D Short. Since the project is not targeting water quality improvement specifically, any water quality benefits as a result of project implementation would be ancillary.
EPA-2	United States Environmental Protection Agency	8-June-09	Figure E-2 is confusing and needs clarification in the FEIS. It should coincide with Table E-1 and the discussion. S176B should be renamed to S-200, the 225 cfs intake pump to the 590-acre water detention basin. Also, S117B should be renamed S199.	Figure E-2 has been recently re-worked to provide greater understanding of monitoring station locations, and to better align it with the information in Table E-1 and in the text. S176B and S100 have been changed throughout the document to reflect the correct names: S-200 and S-199 respectively.
EPA-3	United States Environmental Protection Agency	8-June-09	Main document should provide a short summary of proposed monitoring along with ecological performance standards used to determine project success. It should also include the process for implementing adaptive management in terms of the timeframe required before a change is authorized and initiated.	Sections 6.2 and 8.2.2 of the PIR/EIS summarize the objectives and duration of the Project Monitoring Plan. The full monitoring plan is detailed in Annex E of this report. The ecological monitoring parameters will be following known standards to determine if the project is performing as envisioned.
EPA-4	United States	8-June-09	Public concerns are not referenced on pages 5-	There have been no public concerns regarding

C-111 Spreader Canal Western Project
Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
	Environmental Protection Agency		43 and should be discussed so that the public can determine the absence of EJ. EPA also indicates that these are outdated (2003) and may have changed	Environmental Justice for the proposed project. Recent analysis and the public meeting that was held for the DPIR did not reveal any issues with Environmental Justice. There will be no environmental impacts that are high, adverse, or disproportion to low income, minority, or tribal populations as a result of the proposed project.
EPA-5	United States Environmental Protection Agency	8-June-09	Pages 6-14 states that no relocation assistance would be needed or requires. The FEIS should state more clearly if any resident or businesses would be displaced by the project and, if so, the demographics of those people to be relocated.	At this time, the Corps is not aware of any residents or businesses that would be displaced by the proposed project.
EPA-6	United States Environmental Protection Agency	8-June-09	The FEIS should discuss if the project will attempt to control invasive species on the 776 acres of private lands that are purchased since these will become available for opportunistic invasive species.	A Vegetation Management Plan, including invasive species control, has been developed and is contained in Annex E Part IV.
EPA-7	United States Environmental Protection Agency	8-June-09	Cumulative impacts should include positive impact of other CERP projects (ie. C-111SC Eastern Project, Modified Waters Delivery, and others that are intended to re-hydrate the Everglades and restore flows to Florida Bay).	The C-111 SC Western project anticipates more water from other CERP projects; this analysis was included in the system-wide formulation contained in Section 5 of the PIR/EIS. Direct effects from other projects are not anticipated; only indirect effects.
FDEP-1	Florida Department of Environmental Protection	12-June-09	It was not made clear in the PIR how or why the original project objectives are no longer applicable.	The original project objectives were formulated for the entire project as envisioned in the CERP before it was split into two separate projects. After the splitting of the project, the original project objectives were determined to be too

C-111 Spreader Canal Western Project Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
				broad in scope and were refined. The new objectives are specific to the C-111SC Western project.
FDEP-2a	Florida Department of Environmental Protection	12-June-09	While the project components are designed to redistribute water currently available in the project area, they both appear to capture excess water flows from the C-111Canal. Please explain.	The project does capture run-off in several detention features, which is then made available for the natural system. This water is quantified in Annex C. The Executive Summary has been updated accordingly.
FDEP-2b	Florida Department of Environmental Protection	12-June-09	The PIR is unclear as t whether additional water is or is not made available for the natural system.	The project does make water available for the natural system and is quantified in Annex C. The Executive Summary will be updated accordingly.
FDEP-4	Florida Department of Environmental Protection	12-June-09	DEP recommends using all of the flow transects, as well as the structure discharges, to quantify deliveries to the natural system.	All transects and structures were evaluated to determine the locations affected by the project. Since the focus is quantifying water for natural system provided by the project, only those transects and structures where increased volumes (including improved timing) of water deliveries were captured in this analysis, consistent with Section 373.470, F.S.
FDEP-5	Florida Department of Environmental Protection	12-June-09	How will the objectives for water supply for the environment as required for CERP projects be met?	The project does make water available for the natural system and is quantified in Annex C. The State of Florida will use its water reservation or allocation authority to protect the water made available by the project for the natural system, as required by Section 373.470, F.S. The State has elected to protect the existing water in the natural system that the Project Implementation Report identifies as

C-111 Spreader Canal Western Project
Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
				necessary to achieve the benefits of the project, using water reservation or allocation authority under Florida law. To this end, the South Florida Water Management District will protect the existing water and water made available by the project for the natural system. The Executive Summary will be updated accordingly.
FDEP-6	Florida Department of Environmental Protection	12-June-09	The ecological benefits of restoring the sloughs may not be fully achieved if the hydraulic ridge is not maintained during the sparrow nesting season.	While we concur that the ecological benefits of restoring Taylor Slough might be able to be increased by maintaining the ridge year round, including during the sparrow-nesting season, the Sponsors are constrained so as to not adversely impact the Species, or its Designated Critical Habitat. It is important to note that very little water is available during this time of year (dry season), and it would be very difficult to realize the 10 cm stage, even without the override. It is important to note that all benefits predicted included the sparrow nesting season overrides, and that only very minor reductions in annual flows down Taylor Slough were noted as a result of including these overrides.
FDEP-7	Florida Department of Environmental Protection	12-June-09	Maintaining the hydraulic ridge not only during the wet season but also during the dry season is critical for ecological benefit.	While we might tend to agree with your evaluation, we are constrained so as to not adversely impacting the CSSS or its Designated Critical Habitat. Please also see prior response.
FDEP-8	Florida Department of	12-June-09	The proposed restoration plan may not be as effective if operational protocol is solely based	The operational protocol attempts to maximize flows that stay within Taylor Slough without

C-111 Spreader Canal Western Project Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
	Environmental Protection		on the management of the sparrow.	harming other important aspects of the human and natural ecosystem (including the ENP Panhandle, existing farming operations, and Listed Species). The Draft Project Operating Manual (Annex E) explains these in detail, and provides details regarding the existing and proposed monitoring stations which will be utilized to maximize restoration.
FDEP-9	Florida Department of Environmental Protection	12-June-09	What is the degree and type of unavoidable adverse impacts?	Most significantly, the construction and excavating of project features would permanently alter approximately 104 acres of existing wetlands. However, this loss of wetlands would be offset by restoring and rehydrating approximately 4,015 acres of freshwater and coastal wetlands. Other unavoidable project impacts such as water quality and air quality would be short-term; specifically during construction activities.
FDEP-10	Florida Department of Environmental Protection	12-June-09	The text in the Operation Manual and Figure D-3 should be updated to include the connector between the S-332 C Detention Cell and the S-332C Detention Cell.	We have revised the DPOM text, and Figure D-3, to reflect the fact that the connector between the S-332B West Detention Cell and S-332C Detention Cell, and the connector between the S-332C Detention Cell and the S-332D Detention Cell, are now complete.
FDEP-11	Florida Department of Environmental Protection	12-June-09	The capacity of the expanded S-332 Detention Areas needs to be recognized in the operation plan.	The text and drawings within the Draft Project Operating Manual (DPOM) have been revised to reflect the expansion of the S-332D detention area. While the expanded detention area should be able to accept more water, it should have no

C-111 Spreader Canal Western Project
Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
				effect on the triggers or other operational considerations associated with the C-111 SC Western Project features. Should this change, modifications can be made to the Preliminary Project Operating Manual (PPOM) or Final Project Operating Manual (FPOM).
FDEP-12	Florida Department of Environmental Protection	12-June-09	Figure 3D (Appendix D) needs a label to explain what the colors indicate, and the scale is too small to determine what parcels would be affected.	Figure D-3 is a planning level map intended to provide an "overview" of property ownership; the figure does not represent specific parcel level impacts.
FDEP-13	Florida Department of Environmental Protection	12-June-09	Real Estate Section: Please provide details of the model runs and a clear description of what assumptions were made for the "Existing Conditions Dec 2000".	The Existing Condition Base (ECB) uses Interim Operation Plan (IOP) rules and gets boundary conditions from the SFWMM simulation ECB2.0_2006-2007_WMM5.6.4_LO_0613089. The Initial Operating Regime (IOR) configuration is similar by with some changes to the Frog Pond area. The boundary conditions for the IOR simulations are extracted from the SFWMD 2x2 simulation of IORBs2.0_WMM5.6.4_LO_0613089. Rules are similar to the Alt7R rules. The pre-CERP baseline (PCB1) simulation is defined by the hydrologic conditions on the date of enactment of WRDA 2000. The operations are based on the 2000 ISOP v5.4 rules. The boundary conditions are based on the PCB1_V5.4.2_111604 SFWMM 2x2 simulation.

C-111 Spreader Canal Western Project
Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
FDEP-14	Florida Department of Environmental Protection	12-June-09	Section 3.3.2 (Water Management) is confusing; provide a clearer write-up.	Section 3.3.2 has been revised for easier understanding. However, the subject matter is sufficiently complex; therefore, specific technical information has been retained to avoid omitting necessary details.
FDEP-15	Florida Department of Environmental Protection	12-June-09	Savings clause analysis: confusion over which existing condition modeling scenarios; please explain.	Department Staff correctly noted that the existing conditions baseline (ECB) runs utilized for the Savings Clause Analysis were based on ISOP 2000 operations. The hydrologic modeling, analytical procedures, and calculations performed for these evaluations were based on the information contained and the procedures developed for the draft programmatic Guidance Memorandum 3 ("Savings Clause Requirements"). Department Staff also correctly noted that the Modbranch modeling that was presented in the Engineering Appendix (Appendix A), was based on IOP operations. Unlike the Savings Clause runs, which had to use the operations which were in effect in 2000, the design runs were allowed the flexibility to use the most likely scenario to be encountered, which in this case was IOP.
FDEP-16	Florida Department of Environmental Protection	12-June-09	Section 1.5.2: possible increases in water to the C111SC should be quantified, as additional planning may be needed.	Increases in water to the project area as a result of the Modified Water Deliveries project were included in the project modeling for future with and future without project scenarios. The project team is not aware of any future increases of water that have been proposed at

C-111 Spreader Canal Western Project
Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
				this time.
FDEP-17	Florida Department of Environmental Protection	12-June-09	Section 6.1.3.4: Possible contamination impacts of the spoil material should be assessed to avoid potential adverse impacts on water quality.	For the C-110 Canal plugs, representative soil samples were recently collected and analyzed from the existing spoil piles and at likely locations of new soil plugs. Parameters analyzed and the review was consistent with the extensive analysis performed for the lands to be hydrated at the FPDA, and no potential problems are indicated for water quality or ecological receptors.
FDEP-18	Florida Department of Environmental Protection	12-June-09	A portion of the Frog Pond is leased and is actively cultivated by commercial vegetable farmers. The PIR should address whether or not this farming activity will continue during and after construction of the project.	The farming leases within the Frog Pond area expire in June 2009. Since the existing leases will not be renewed, active farming cultivation in this area will cease at that time.
FDEP-19	Florida Department of Environmental Protection	12-June-09	Frog Pond contaminants and pesticides: Coordinate with DEP's Waste Cleanup Section for comments and recommendations on the removal, disposal and/or monitoring of contaminated material.	Coordination with DEP's Waste Cleanup Section has been on-going; Currently, the design contractor, WRS, is completing the 100% design of the Detention Area. Based on the Final 100% design, a Soil Management Plan will be submitted to the FDEP for review and concurrence. It is anticipated that the soil will be staged outside of the levees for future use. Additionally some of the scraped material may be used onsite for roads or within levees. The actual use of this material onsite will be at the construction contractor's discretion, subject to site-specific testing. However any on site use will also need to be in compliance with FDEP

C-111 Spreader Canal Western Project Comment Response Matrix				
Comment Number	**Organization / Agency**	**Date Received**	**Comment**	**Response**
				and FWS requirements. The purpose of the soil management plan is to address these issues.
FDEP-20a	Florida Department of Environmental Protection	12-June-09	Project Monitoring Plan – Water Quality Compliance: Please explain why the plan calls for NH4 sampling at two critical stations – S-177 and S-178	The additional sampling locations for NH4 at S-177 and S-178 are to some degree intended to resolve uncertainties related to the subsequent Spreader Canal phase. As one of the most bio-available forms of inorganic nitrogen, it will become very important to establish a baseline regarding NH4 concentrations from these two structures.
FDEP-20b	Florida Department of Environmental Protection	12-June-09	Project Monitoring Plan – Water Quality Compliance: Per *Section E.1.4*, baseline dataset sampling for NH4 will be initiated In October 2009. The duration of the monitoring should be specified.	We have appended *Section E.1.3 - Duration* to indicate that "The duration of all monitoring recommended within this plan shall not exceed 5 years unless required by permit, and the duration of monitoring for individual parameters may be less than 5 years, contingent on the Permittee applying for, and receiving, 373.1502 permit modifications.
FDEP-20c	Florida Department of Environmental Protection	12-June-09	Project Monitoring Plan – Water Quality Compliance: In *Section E.2-Geographic Location*, the regional area for the C-111 Spreader Canal Western project should be mentioned rather than just the Project PIE. To that end, more background information should be given on the PIE monitoring plan. For the purposes of the permit application/water quality monitoring plan review, the document should be submitted to the Department.	We have revised *Section E.2 – Geographic Location* so that is no longer limited to a discussion of the PIR project. This was question 13a of the second RAI which was received in response to the 1502 permit application.
FDEP-20d	Florida	12-June-09	Project Monitoring Plan – Water Quality	We have revised Annex E-Draft Project

C-111 Spreader Canal Western Project
Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
	Department of Environmental Protection		Compliance: The stations shown in Figure E-2 do not match the stations given in Table E-1. These stations should be shown in context to the proposed plan features. For regulatory purposes, the plan should also include flow, stage, and rainfall data	Monitoring Plan, Part 2-Regulatory Plan: Water Quality Compliance so that the station designations described in figure E-2 are now consistent with the station designations given in Table E-2. We have also revised Figure E-2 so that the station locations are depicted in relation to the proposed C-111 SC plan features. As described in the Hydrometeorological Monitoring Plan (Annex E, Part1), flow will continue to be monitored at S-174, S-175, S-177, S-178, S-18C, S-197, and S-332D, stage will continue to be monitored at S-174, S-175, S-177, S-178, S-18C, S-197, and S-332D, and rainfall will continue to be monitored at S-174, S-177, and S-18C. In addition to the existing stage monitoring, new sites will be established within the Frog Pond Detention Area header cell, and Aerojet Road Canal Feature, as well as several additional sites (e.g. CSSS Units 3 and 4).
FDEP-20e	Florida Department of Environmental Protection	12-June-09	Project Monitoring Plan – Water Quality Compliance: Please describe what monitoring is proposed to occur during construction	From a water quality perspective, we anticipate that the pending 1502 permit may include a requirement for turbidity monitoring during construction. We also currently in the process of drafting a soil management plan which will set forth how Copper contaminated soils within the Frog Pond will be excavated, and relocated. This plan will also likely include confirmatory sampling, and/or leachability testing for Copper following scrape down of the detention area.

C-111 Spreader Canal Western Project Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
FDEP-20f	Florida Department of Environmental Protection	12-June-09	Project Monitoring Plan – Water Quality Compliance: Please describe what parameters are included in the pesticide suite	We have revised the Monitoring Plan text to indicate that the parameters are FDEP's Group AA parameters
FDEP-20g	Florida Department of Environmental Protection	12-June-09	Project Monitoring Plan – Water Quality Compliance: Please explain why surface water quality samples are taken at S-177 but not at pump station S-199	S-177 and S-199 will be within 250' of each other and essentially share the exact same source water. As such, additional sampling at S-199 would appear to be somewhat redundant.
FDEP-20h	Florida Department of Environmental Protection	12-June-09	Project Monitoring Plan – Water Quality Compliance: The water quality monitoring plan should address the inclusion of grab samples within the two "detention areas" downstream until we have established that there are no issues with the sites. Consider adding one site in the FPDA at the south end of the header channel and one in the Aerojet Canal after the culvert crossing under the road. Zinc and copper should be included as parameters for the FPDA.	In order to confirm there are no issues with the sites, the water quality monitoring plan has been revised to include a quarterly grab sample at the south end of the FPDA header channel and one in the Aerojet Canal after the culvert crossing under Aerojet Road. Collection of these samples will need to be predicated on having sufficient water to properly sample surface water.
FDEP-20i	Florida Department of Environmental Protection	12-June-09	Project Monitoring Plan – Water Quality Compliance: Please explain how the guidance from CERP Guidance Memoranda #42, Toxic Substances Screening Process - Mercury and Pesticides, will be incorporated into the monitoring plan. The current plan does not include any fish tissue or sediment monitoring for Hg	As part of the District pre acquisition assessment and interim land management Best Management Plan the District conducted site visits and soil and ground water assessments. During the 2006 Phase II ESA soil samples were collected from over 1,300 acres within the Frog Pond, and an additional 350 acres in 2009. The soil sampling meets the established protocols in both the US Fish and Wildlife Service and the South Florida Water

C-111 Spreader Canal Western Project
Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
				Management assessment guidelines and the CERP Guidance Memoranda #42, Toxic Substances Screening Process - Mercury and Pesticides. No elevated mercury levels were detected above the Sediment Quality Assessment Guidelines Threshold Effects Level of 0.18 mg/kg. Low levels of historic agrochemicals (4,4-DDE, 4,4-DDT, and chlordane) were detected in several 50-acre grids that pose a potential risk to the Service's trustee species. However these impacts are located outside the detention area footprint. Post construction monitoring described in CGM 42 appears to be geared towards identifying the fate of Mercury as a result of treatment trains such as STAs and reservoirs (bodies of water collected for storage and future use). While the C-111 Spreader Canal Western Features Project does include an above ground impoundment designed to infiltrate surface water into groundwater (for purposes of reducing seepage from Everglades National Park), it does not contain STAs or traditional reservoirs, and involves no surface water discharge. Because of this, and because elevated mercury levels were not detected above the Sediment Quality Assessment Guidelines Threshold Effects Level (0.18 mg/kg), the Corps believes that additional assurances regarding Mercury (or pesticides) are not necessary at this time.

C-111 Spreader Canal Western Project
Comment Response Matrix

Comment Number	Organization / Agency	Date Received	Comment	Response
FDEP-21	Florida Department of Environmental Protection	12-June-09	CERPRA permit: Reasonable assurances must be provided to ensure that any discharges from the project will meet the State's water quality standards.	Concur
FDACS-1	Florida Department of Agriculture and Consumer Services	12-June-09	FDACS is concerned that a rise in groundwater elevations could result in root zone flooding that will be detrimental to crops. The recommended plan does not include funds for the purchase of private lands impacted by the project.	Table D-2 within *Appendix D – Real Estate* indicates that privately owned lands may need to be acquired (in fee) in order to fully realize project benefits. Because of uncertainties inherent in any modeling exercise, and because the project will be actively managed in order to minimize the need to acquire privately owned lands, it is not possible to identify, prior to operational testing and monitoring, which parcels (if any) will actually need to be acquired. *Annex E – Hydrometeorological Monitoring* provides details regarding the $1.5 Million Hydrometeorological monitoring plan which will be utilized to monitor project effects, and provide the feedback needed to avoid the negative consequences which would accompany adverse increases in groundwater levels.
FDACS-2	Florida Department of Agriculture and Consumer Services	12-June-09	Page X of the Executive Summary: What does "alteration of agricultural requirements" mean? The USACE should not consider any alternative that adds flooding risk to private agricultural property to achieve "increased hydroperiods" on public lands.	The project anticipates raising water levels in the Frog Pond and Aerojet areas to establish a hydrologic barrier to prevent seepage from the west, thus keeping water in Taylor Slough for restoration purposes. Present farming activities in the Frog Pond will cease in June 2009 due to expiration of property leases from the SFWMD.

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				Lands identified through modeling output potentially affected by increased water levels have been acquired. Monitoring of water levels will continue during the operation of the project to ensure no adverse impacts to private lands.
FDACS-3	Florida Department of Agriculture and Consumer Services	12-June-09	Growers projected to be within the area of the project impacts are particularly concerned about the possibility of irreversible harm and unintended consequences given the project unknowns and what they've seen of court ordered interventions in other areas. Some have taken the position that if the integrity of private land interests are threatened then the project should purchase the property rather than experiment with someone's livelihood and property value.	While it is difficult to anticipate future court ordered interventions, the project has committed significant resources in order to be able to monitor project effects, including any unintended consequences related to flooding. Perhaps more importantly, the project Sponsors have committed to actively manage the project so as not to adversely affect private land interests. It is important to note that the *Project Operating Manual* contains numerous safeguards including weekly operations meetings, preservation of pre-storm drawdowns, and the ability to immediately lower water control elevations in response to real time data. As described above, the Project Implementation Report will, in effect, request Congressional Authorization for funds to purchase privately owned lands, should it be determined, through operations, that these lands are needed in order to fully realize project benefits.
FDACS-4	Florida Department of Agriculture and	23-June-09	The potential for negative impacts to the privately owned agricultural properties in the vicinity of the project is our area of interest.	Please see response to FDACS-1 above.

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	Consumer Services		FDACS is concerned that a rise in groundwater elevations could result in root zone flooding that will be detrimental to crops.	
FDACS-5	Florida Department of Agriculture and Consumer Services	23-June-09	As the local sponsor, the SFWMD is responsible for acquiring the private land impacted by the project. At this time, SFWMD has not identified any funds for this purpose so special care must be taken to avoid negative consequences that would accompany an increase in groundwater levels on private agricultural properties.	Please see response to FDACS-3 above.
FDACS-6	Florida Department of Agriculture and Consumer Services	23-June-09	It is disconcerting to see the following statement on page x of the Executive Summary. "Implementation of the recommended plan or other action alternatives is expected to result in a degree of unavoidable adverse impacts. Specifically, increased hydroperiods will result in an alteration of agricultural requirements; and some existing wetlands would be permanently altered by the construction and excavation of project features. These impacts, however, would be offset by restoring and rehydrating a larger extent of freshwater and coastal wetlands." What does "alteration of agricultural requirements" mean? The USACE should not consider any alternative that adds flooding risk to private agricultural property to achieve "increased hydroperiods" on public land.	Please see response to FDACS-2 above.

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FDACS-7	Florida Department of Agriculture and Consumer Services	23-June-09	Real Estate Takings analyses criteria Appendix D: This section identifies 776.06 acres of private land that will be impacted by the project according to the real estate taking criteria below. This criterion "allows" wet season groundwater level increases above the 0.5 feet below ground level that could extend root zone flooding by months before a real estate taking is identified. The 776.06 acres are those that experience impacts greater than the taking criteria.	The 776 acres of private-owned lands that may experience adverse flooding as a result of the Recommended Plan, would be acquired as a result of project implementation as indicated in Section 8 of the PIR/EIS.
FDACS-8	Florida Department of Agriculture and Consumer Services	23-June-09	PIR paragraph Executive summary page xiii describing SFWMD Funding: The excerpt below describes funding that is not currently part of the SFWMD planning process. The 776 acres of private land represent ~ $ 30,000,000 of real estate cost in the ~ $ 48,000,000 projected real estate cost in the PIR.: "Regarding the level of service for flood protection, project modeling indicated that approximately 11,565 acres of land could be impacted by the operation of the project. The SFWMD has agreed to acquire in fee privately owned lands, totaling 776 acres, which are determined to be, or to have been, impacted by operation of the project."	The Real Estate costs included estimates for the acquisition of the 776 acres of privately owned lands.
FDACS-9	Florida Department of Agriculture and	23-June-09	Section 7.23 - Unavoidable Adverse Impacts to Agriculture Issue: The premise of the excerpt below is not acceptable to agricultural	This evaluation is specific to the Frog Pond area and Section 7.23 has been revised to reflect that area. As stated in FDACS-3, present farming

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	Consumer Services		stakeholders that will be impacted by the project. "Existing production of ornamental trees, nursery crops, and commodity row crops would be permanently altered in areas subject to freshwater rehydration and increased hydroperiods unsuitable for agricultural requirements." During meetings with SFWMD and USACE staff, growers have been assured that no such impacts will be occurring to their private lands, crops, and livelihood.	activities in the Frog Pond will cease in June 2009 due to expiration of property leases from the SFWMD.
FDACS-10	Florida Department of Agriculture and Consumer Services	23-June-09	Section 7.25 – Cumulative Effects: The "permanently removing existing acres from agricultural production" in the excerpt above should not be occurring due to the C-111 West Spreader Canal project as currently represented to agricultural land owners in the vicinity of the project.	Again, this evaluation is specific to the Frog Pond area, and Section 7.25 has been revised accordingly.
FDACS-11	Florida Department of Agriculture and Consumer Services	23-June-09	Executive Summary Unresolved Issues – page xv: The excerpt below indicates that there are no unresolved private interest issues. Based on previous concerns, this should be revisited: "UNRESOLVED ISSUES There are no significant, unresolved issues that have been presented by stakeholders, public or private interests. The project will not result in a reduction in the quantity of water available to meet demands for water supply. Effects on adjacent lands have been evaluated as part of the level of service of flood protection	As a result of the project assurances analysis, any private lands that would be adversely affected by project induced flooding would by acquired by the project sponsors. Therefore, there are no unresolved issues.

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			analysis."	
NC-1	The Nature Conservancy	22-June-09	We urge that the hydrologic, vegetation, and population monitoring recommendations in Annex E be implemented. Further, the CSSS management and mitigation plan for the study area should be developed as recommended. If sub-populations C and D are likely to be displaced as higher water levels or longer hydroperiods in those areas result in changes in habitat, it is critically important that alternate habitat be identified at sites that are not likely to be impacted by the project. We suggest that restoration of historic marl prairie on the eastern portion of the Model Lands may be appropriate mitigation for critical habitat lost to the sparrow. As such, planning and funding for the restoration effort, which would include removal of exotic invasives and woody vegetation, intensive fire management and possibly some wetland restoration, should be incorporated into this Project PIR.	It is the intent of the USACE and SFWMD to proceed with the proposed Project Monitoring Plan. The project sponsors have coordinated all aspects of CSSS monitoring with the FWS in an attempt to minimize potential project impacts to the sub-species and associated critical habitat. Initial model output indicates the potential establishment of suitable CSSS habitat in areas presently not conducive for nesting activities. This too, will be monitored during project operations. Compensation for impacts to the CSSS or critical habitat has been established through the Conservation Measures outlined in the Biological Assessment (Annex A). If FWS determines that additional compensation above what has been proposed is warranted, habitat management in the Model Lands will be considered.
DERM-1	Miami Dade Department of Environmental Resources (DERM)	23-June-09	It may be possible to achieve further cost-savings by refining the sizing of Frog Pond Detention Area (FPDA) for the amount of water available to the project. If the third cell is not being utilized, as shown in the modeling results, it may be possible to reduce or reconfigure the reservoir to efficiently utilize three cells. If a smaller total size could be	The FPDA, part of the recommended plan, was modeled in its entirety (530-acres) for the evaluation and comparison of alternatives. Project modeling using the Modbranch model indicated that the project benefits would be realized with a 530-acre FPDA. The comment appears to refer to modeling for preliminary design, which at this time has not been

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			used, the project could realize cost savings for both construction and maintenance. Concerns are expressed about leaving an unused cell open to exotic and invasive species with no project benefits. A smaller reservoir could also reduce expose of wildlife to toxic chemicals. If the currently unused capacity in the FPDA is designed to handle future increases in available water as other CERP components come on line, the Western project should consider delaying or sequencing construction of the third cell until the Eastern PIR is implemented or other CERP or non-CERP projects come on line that might provide additional water to this area. The resulting short term cost savings to this project could be redirected to improve other features and/or project monitoring.	completed. Currently, the preliminary design modeling does demonstrate that the proposed third cell of the FPDA is utilized at times to reinforce the hydraulic ridge; however, more optimal design will continue to occur through continued refinement. In regards to the comments on possible residual agricultural chemicals in this area, the design and operation of the FPDA will be required to be in accordance with all applicable law and regulations regarding water quality and contaminants.
DERM-2	Miami Dade Department of Environmental Resources (DERM)	23-June-09	We recommend that plans to plug the C-110 canal be replaced with a plan to completely backfill the canal, beginning at its southern terminus near the C-111 Canal and proceeding north at least to the intersection of the canal with theoretical SW 472 Street (aka FWC Road). Should the project proceed with plugging despite this recommendation, the levees on both sides of the canal should be left at least 0.5 feet above the seasonal high water level, both to preserve access for a future project to completely backfill the canal, and to prevent short-circuiting of water around the	The projects that are referenced in the comment are in separate geographical areas of the Everglades with different underlying geological structure. Hydrologic modeling of plugging vs complete backfilling demonstrate that plugging of the canal in this particular area is as hydrologically as effective as completely backfilling the canal. Plugging of the canal, represents a cost savings as there is not enough fill material onsite to backfill the entire canal. Fill material is expensive, and fully backfilling the canal would result in a significant cost increase for the proposed project. If post-

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			plugs during the wet season. This modest elevation may help keep the soil on the remnant levee saturated, minimizing the opportunity for invasive exotic plants to infest the area and thus minimizing land management costs until funding for full backfill can be obtained.	construction monitoring shows that plugging is not as effective as desired, it is possible that backfilling of the entire C-110 Canal will be considered for the C-111 Spreader Canal Eastern project. The non-Federal sponsor is also exploring avenues outside of CERP for backfilling the entire C-111 Canal. Additionally, the design for the plugs has not been finalized; however, the recommendations in the comment will be considered during the ongoing design phase.
DERM-3	Miami Dade Department of Environmental Resources (DERM)	23-June-09	More documentation is needed to support the conclusion that the wetlands east of the FPDA in the Southern Glades Wildlife and Environmental Area (SGWEA) and Southern Glades Addition will benefit from the Western PIR project features. The continued existence of the C-111 Canal and plans to plug rather than backfill the C-110 Canal (see above comment) means that two major drainage features in the SGWEA will continue to operate, potentially limiting projected benefits as the project is actually implemented. These problems would include limiting food supply and increasing invasive exotic plant species, that may lead to increasing cost of land management. We recommend that the monitoring plan be optimized in the lands east of the FPDA, and especially in the SGWEA and Southern Glades Addition, by crafting	The C-111 Canal will continue to operate, although with less frequent structure openings, and less water discharged to tide. As indicated in the Draft PIR, there may be some unintended effects across the proposed project area as a result of project operations, such as possible drawdown effects in the wetlands adjacent to the C-111 Canal due to shift in operations related to the FPDA and Aerojet features. These effects and the continued influence in the C-111 Canal were included in the quantification of benefit (Habitat) units for the proposed project. Regarding the plugging of the C-110 Canal, it is believed that this feature will adequately block the drainage effects of the Canal. If unsuccessful, it is likely that backfilling of the entire C-110 Canal will be considered for the C-111 Spreader Canal Eastern project. Additionally, the non-Federal

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			local scale performance measures that will allow early detection of hydrologic changes that could lead to vegetation shifts if not remediated through adaptive management. Detailed hydrology and vegetation monitoring similar to that being conducted for vegetation in the Cape Sable Seaside Sparrow Population D region should be conducted northeast of the junction between SW 424 Street and the C-111E canal, and near the junction of the C-110 and the C-111 canals to provide for early detection of potential problems.	Sponsor is currently exploring avenues outside of CERP for backfilling the entire C-110 Canal. Both the Federal, and non-Federal Sponsor recognize the significant commitment that DERM has made in both acquiring and continuing to maintain Environmentally Sensitive Lands in the SGWEA and SGA. Project features including the plug in L-31E, increased triggers at S-20, S-198 structure, and experimental trigger changes at S-18C are intended to benefit these lands that are located east of the C-111 Canal. We agree that it is important to detect hydrologic changes that are attributable to project operations before these changes impact any lands. To that end, an approximately $1.5 Million Hydrometeorological Monitoring Plan will make use of eleven (11) new monitoring stations, four (4) enhanced monitoring stations, and forty-six (46) existing monitoring stations. Using the collective information in the hydrometeorological monitoring plan, changes in the hydroperiods will be closely monitored in the SGWEA and SGA areas to determine if operational adjustments are needed. Data will be reviewed periodically in cooperation with resource agencies to determine how any adjustments should be made and if additional monitoring, such as vegetation transects, is warranted. Monitoring resources may also be

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				reallocated to address identified needs as conditions change.
DERM-4	Miami Dade Department of Environmental Resources (DERM)	23-June-09	We recommend further assessment of the project's effect on the degree of salt intrusion to the aquifer in the project area. There is a zone downstream from the S-198 structure where modeling indicated that wetland hydroperiods would be shorter than under existing conditions as a result of project implementation. Please note that this zone is coastward from the latest United States Geological Survey (USGS) provisional salt intrusion line at the base of the aquifer in this region. Changes in hydrology in this area could translate into further local movement of the salt intrusion line, and an increased risk for impacts to upstream municipal and private well stakeholders such as the Florida Keys Aqueduct Authority (FKAA), Everglades Labor Camp, and the cities of Florida City and Homestead. We recommend additional optimization of project infrastructure (S-198 location) and operations (S-18C and S-198 triggers) to eliminate this effect. Assuming that the S-18C trigger stages could be raised somewhat, we suggest that such impacts might be relieved if the S-198 were moved downstream toward the S-197 and S-198 operations were adjusted to maximize wetland benefits without affecting upstream flood	The overall project benefits, and impacts, have been documented as the area weighted sum of changes in habitat units as a result of the aggregated project features. Because the project was formulated for system wide benefits, there has been no attempt to quantify compartmentalized benefits. As noted, the C-111 Canal will continue to operate, although with less frequent structure openings, and less water discharged to tide. Although they may not perform as well as a full backfill, the ten proposed C-110 plugs will undoubtedly reduce canal induced seepage. Please note that the Non-Federal Sponsor is currently exploring avenues outside of CERP for backfilling the entire C-110 Canal. Both the Federal, and Non-Federal Sponsor, recognizes the significant commitment which DERM has made in acquiring and continuing to maintain, Environmentally Sensitive Lands in the SGWEA and SGA. It was largely because of these lands that features were formulated to attempt to improve hydroperiods east of the C-111 Canal. These features include the plug in L-31E, increased triggers at S-20, S-198 structure, and experimental trigger changes at S-18C. We agree that it is important to detect hydrologic changes that are attributable to project

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			protection. We recommend that project implementation include a delay in construction of the S-198 to allow time for this optimization to occur. We also suggest that the project monitoring plan be modified to add performance measures to address potential wetland impacts between the S-18C and the S-197 and potential changes to the location of the salt intrusion line in the SGWEA. It is essential that this area be closely monitored for hydrologic and ecological changes that could indicate adverse impacts to the salt intrusion line.	operations before these changes impact any lands. To that end, the $1.5 Million +/- Hydrometeorological Monitoring Plan will make use of eleven (11) new monitoring stations, four (4) enhanced monitoring stations, and forty-six (46) existing monitoring stations. Using the collective information in the hydrometeorological monitoring plan, changes in the hydroperiods will be closely monitored in the SGWEA and SGA areas to determine if operational adjustments are needed. Data will be reviewed periodically with the resource agencies to determine how these adjustments should be made and if additional monitoring, such as vegetation transects is warranted. Monitoring resources may be reallocated to address identified needs as conditions change.
DERM-5	Miami Dade Department of Environmental Resources (DERM)	23-June-09	Further assessment and monitoring of the project's effect on base flows to Manatee Bay and Barnes Sound via the C-111 is recommended. Due to the physical configuration of these basins, mixing and flushing rates are low, and they are vulnerable to both hypersalinity during drought or dry periods, and impacts from releases during extreme events. They suggest that the effects on Manatee Bay and Barnes Sound were not adequately evaluated. The use of all available tools, including but not limited to the Biscayne Bay TABS-MDS hydrodynamic model, USGS	The project operations are designed to divert water to Taylor Slough and the Panhandle during periods when there is excess flow at the S-174 structure. The project is not likely to result in ecologically significant increase in dry season salinity in Manatee Bay and Barnes Sound since the project pumps will not operate during the dry season. The project will slightly enhance salinity conditions in these water bodies during high flow events since it will divert some flood flows from the S-197 structure. The Corps believes that impacts to Barnes Sound and Manatee Bay are likely to be

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			models, and/or salinity regression equations for the region that have been recently developed, be utilized prior to construction of this project to better evaluate the effects of this project on Manatee Bay and Barnes Sound.	minimal and that additional modeling would not sufficiently reduce uncertainties regarding this assessment. The hydrometeorological monitoring plan will be used to evaluate the need for operational adjustments to enhance these two water bodies as well as other areas within the project study area.
DERM-6a	Miami Dade Department of Environmental Resources (DERM)	23-June-09	Water Quality concern 1: FPDA has a history of agricultural use, and the project acknowledges that the soils have elevated levels of copper and other metals, plus pesticide residues. A contingency plan should be available that addresses whether and how the project will proceed and what steps will be taken to protect wildlife if complete removal of contaminated soils is either not possible through conventional means or complete removal severely impacts the functioning of the FPDA.	The assessment of soil contamination within the FPDA has been fully coordinated with toxicologists at the USFWS as well as with the staff of the DEP Solid Waste Management Department. The non-federal sponsor, the SFWMD, is currently in the process of drafting a soil management plan which will set forth how contaminated soils within the Frog Pond will be excavated, and relocated. This plan will also likely include confirmatory sampling, and/or leachability testing for Copper following scrape down of the detention area. The final plan will be vetted by the USFWS and the DEP.
DERM-6b	Miami Dade Department of Environmental Resources (DERM)	23-June-09	Water Quality concern 2: Water in the C-111E periodically does not meet applicable state water quality standards, either for total phosphate or for other contaminants of concern. This issue is not directly addressed in the draft PIR because currently the water in the secondary canal mixes with the relatively less impacted water in the C-111 prior to discharge to Everglades National Park or the coast. There	A review of the past 10 years of S-178 flows and coincident S-18C flows show that flood control releases at S-178 are coincident with larger releases at S-18C. Diversion of flows to Taylor Slough and out of the lower C-111 canal will occur during periods when there is adequate remaining water in the C-111 canal to dilute C-111E flows. No significant degradation of C-111 canal water quality is

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			is a possibility that the project could result in decreased water quality for the water moving down the C-111 Canal, even if numerical state water quality standards may still be met. Also, there may be potentially harmful constituents for which there are no established water quality criteria, contaminants may reside in sediments, that could be transported downstream, or concentrations of total phosphate that are higher than background could adversely affect areas outside of ENP. DERM staff recommends that water quality concerns should be evaluated not just by compliance with numerical criteria, but also by comparison to existing conditions and narrative antidegradation standards. Since we understand that there are few if any modeling tools to evaluate water quality issues, we recommend that adequate pre- and post-project monitoring be included to assist in adaptive management.	expected to occur because of this. The project water quality management plan along with ongoing monitoring efforts in the basin will be used to determine the impact of the project on basin water quality as recommended by the commenter.
DERM-7	Miami Dade Department of Environmental Resources (DERM)	23-June-09	Development of an appropriate cost-effective method for generating environmentally compatible water quality downstream from the S-178 structure in the C-111E. Methods that could be tested range from simple wetland filtration areas to capture nutrients or other contaminants that adsorb on sediment particles to full-scale Stormwater Treatment Areas. The State of Florida should simultaneously	We appreciate the comments regarding the future-proposed Eastern PIR. Although the Eastern PIR is not scheduled to begin for some time, efforts are constantly being made to refine the CERP program. At this time, we cannot predict the methods and analysis that will be conducted for future studies; however, the commentary will certainly be considered for future restoration efforts in the project area.

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			commence a program to work with the stakeholders on source reduction in the watershed of the C-111E. Sufficient time must be allocated in the Eastern PIR schedule to develop and implement a test project for water quality improvement in this basin.	
DERM-8	Miami Dade Department of Environmental Resources (DERM)	23-June-09	Development of an appropriate modeling tool for the project area that addresses parameters of concern to the project. The Western PIR was limited in predictive modeling capability because the available models did not address either salt transport in surface and groundwater, other water management infrastructure in the region, or tidal influence on groundwater levels in the project area. There was also no link to a downstream hydrodynamic model that would allow evaluation of benefits in the downstream estuaries. We recommend that an Eastern PIR be initiated that will contain sufficient time in the schedule for development of an appropriate set of predictive tools for this project area.	We appreciate the comments regarding the future-proposed Eastern PIR. Although the Eastern PIR is not scheduled to begin for some time, efforts are constantly being made to refine the CERP program. At this time, we cannot predict the methods and analysis that will be conducted for future studies; however, the commentary will certainly be considered for future restoration efforts in the project area.
DERM-9	Miami Dade Department of Environmental Resources (DERM)	23-June-09	The wetlands of the Southern Glades and Model Lands basins are high in functional quality, and have a surface water connection to Everglades National Park, Biscayne National Park, the Card Sound Aquatic Preserve, Crocodile Lakes National Wildlife Refuge, and the Florida Keys National Marine Sanctuary.	We appreciate the comments regarding the future-proposed Eastern PIR. Although the Eastern PIR is not scheduled to begin for some time, efforts are constantly being made to refine the CERP program. At this time, we cannot predict the methods and analysis that will be conducted for future studies; however, the

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			Most of these are designated by the state of Florida as Outstanding Florida Waters, and are subject to antidegradation standards. The water that is likely to be delivered to a future spreader canal will be of uncertain quality until results from Western PIR implementation are obtained. Should the Western PIR prove highly effective at reducing seepage out of Taylor Slough, water quality in the C-111 and C-111E canals could be degraded relative to the present condition, although state water quality standards might still be met. It will be important for the Eastern PIR to have the necessary monitoring data and modeling tools to evaluate and address potential effects of the future water quality in the C-111 and C-111E canals, which will be the source of water for the future spreader canal.	commentary will certainly be considered for future restoration efforts in the project area.
NGO-1	Audubon of Florida Everglades Foundation National Parks Conservation Association Natural Resources Defense Council Sierra Club, Miami	23-June-09	The language in the executive summary should be made consistent with Annex C and with WRDA 2000 ("which requires the identification of the quantity, timing, and distribution, of water for the natural system).	The document has been revised for consistency in regards to Project Assurances and Savings Clause.

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	Tropical Audubon Society World Wildlife Fund			
NGO-2	Audubon of Florida Everglades Foundation National Parks Conservation Association Natural Resources Defense Council Sierra Club, Miami Tropical Audubon Society World Wildlife Fund	23-June-09	The criteria and timetable that allow S-18C to be operated to provide the benefits described in the PIR be clearly outlined.	While the DPOM identified the potential added benefit, specifically increased flow in Taylor Slough, which might be able to be realized if increased stages could be permanently implemented at S-18C, because of their temporary nature (under this PIR/EIS), no natural system benefits were quantified, nor water identified for protection related to the S-18C operations. A timetable was presented in Annex D Figure D-10 which proposes a systematic increase in water level controls to reduce seepage from Taylor Slough through the operational testing of S-18C. The results of this test will identify the potential flood control impacts and real estate requirements needed to recommend a permanent change in water level control at S-18C as part of the Eastern PIR recommended plan. Both the Federal and Non-Federal Sponsor remain committed to taking all practicable steps needed to increase Taylor Slough flows to the point that the ecosystem favorably responds.
NGO-3	Audubon of Florida Everglades	23-June-09	Ensure that this project utilizes the monitoring provisions that allow for identification of potential flooding and water quality problems,	We concur that levels of service for flood protection should not be defined based on the root zone of a particular crop type. The root

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	Foundation National Parks Conservation Association Natural Resources Defense Council Sierra Club, Miami Tropical Audubon Society World Wildlife Fund		and subsequently address those problems not solved in the Western Project in the Eastern Project PIR.	zone metric is intended to minimize the potential for crop damage to the extent that this can be achieved within the overall project purposes. Additionally, attention to the root zone will be necessary to ensure that crops are not damaged as a result of the incremental increases at S-18C, which were not formally analyzed under the Savings Clause. Understanding the relationship of changes in the root zone water levels and the regional operational changes of the C&SF system also helps to identify the potential mitigation requirements (engineering solutions to protect or acquisition of impacted real estate) in order to improve environmental conditions in Taylor Slough. Any future C-111 Spreader Canal Eastern project will be required to address all potential flooding and water quality issues in accordance with applicable regulations and law.
NGO-4	Audubon of Florida Everglades Foundation National Parks Conservation Association Natural Resources Defense Council Sierra Club,	23-June-09	Ensure that planning and implementation of the Eastern Project, including the removal of the lower C-111 canal, begin expeditiously thereby restoring Florida Bay, Biscayne Bay, and the south Dade wetlands.	Although the Eastern PIR is not scheduled to begin for some time, efforts are constantly being made to refine the CERP program. The issue of the timing of any future Eastern PIR has been raised and will be evaluated for a possible change in CERP project sequencing.

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	Miami Tropical Audubon Society World Wildlife Fund			
DOI-1	Department of Interior	23-June-09	NPS states that monitoring and adaptive management plans should include; 1) Surface water and groundwater monitoring that addresses potential contaminants of concern such as nutrients, pesticides, and metals within Taylor Slough and the Southern Glades wetlands. 2) Nutrient enrichment bioassessment monitoring at the Frog Pond Detention area and transects that extend into the Taylor Slough marsh. 3) Fish bioaccumulation monitoring for pesticides and metals for native fish at the existing Taylor Slough monitoring stations.	1) The project features are designed so that there will be no surface water discharges to Everglades National Park. The existing surface water monitoring in the source canals demonstrates compliance with state standards. The Corps and its local sponsor believe that the existing monitoring of nutrients collected by Everglades National Park staff as required by the Settlement Agreement and the TP Rule is sufficient to understanding nutrient loading in Taylor Slough. The project co-sponsor, the SFWMD, currently samples stations upstream of the proposed Detention Areas and associated groundwater wells for pesticides, the results of which have with few exceptions met standards. Similar sampling for trace metals, have shown so few excursions from the standards in the past that the SFWMD has systematically removed trace metals from its monitoring requirements. The exception to this has been mercury which is primarily derived from atmospheric deposition as opposed to surface water runoff. Site specific monitoring associated with potential residual trace metal and pesticide contamination in the FPDA has been incorporated into the

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				monitoring plan. 2) The planned FPDA is not designed to function as a wetland, but rather as an infiltration basin. Monitoring of nutrient enrichment in the FPDA would be compromised by routine maintenance activities such as vegetation management. As stated above, the FPDA is not designed to have a surface water discharge so the Corps and its sponsor do not consider it a significant source of nutrient loads in Taylor Slough. For this reason, vegetation transect monitoring into Taylor Slough is not planned as part of this project. However, the Corps recognizes the value of this type of monitoring and encourages the Park and others to continue to conduct such studies in the Taylor Slough basin. 3) The SFWMD conducts monitoring of surface waters for pesticides and mercury at stations upstream of the inflows to these detention areas. The Corps and the SFWMD believe this monitoring to be sufficiently protective.
DOI -2	Department of Interior	23-June-09	Consideration should be given to extending the Frog Pond detention feature northward to connect fully with the existing C-111 detention area complex, so that better control of seepage from Taylor Slough can be accomplished. Any gaps in the seepage control system may	The extension of the FPDA northward was included in the FPDA sizing analysis that has been added to the PIR. The northern position of the FPDA was sited to avoid higher quality wetlands that exist to the north of the proposed feature. Two ongoing efforts outside the

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			compromise the benefits expected from a more natural hydroperiod in Taylor Slough.	C111SC Western project are directed at reducing seepage out of this area. Contract number 9 of the C-111 South Dade project contains features that would be implemented in this area in order to reduce seepage levels out of ENP. Additionally, ongoing operational evaluations for the C&SF project should also serve to reduce seepage out of ENP, specifically operations related to S-332D. In the spirit of Incremental Adaptive Restoration, these efforts will be followed until the initiation of the Eastern PIR. If seepage in this area becomes a concern, it will likely be addressed in the Eastern PIR.
DOI -3	Department of Interior	23-June-09	The NPS recommends that the plugging of the C-111 SC western Phase 1 project be fully integrated, in design and scheduled implementation, with the plugging in the C-111 South Dade project. To better complete the objectives of the project, NPS recommends plugs at several additional sites 1) The L-31 W must be backfilled and/or adequately plugged to ensure the C-111 SC detention areas function properly. For the Aerojet feature to be fully functional, the drainage imposed by the L-31W must be stopped. 2) The Aerojet Canal system currently has an east-west feeder canal that will compromise the effectiveness of the recommended project plan. NPS recommends that this canal be plugged in coordination with	The majority of the L-31W Canal will backfilled under Contract Number 9 of the C-111 South Dade project. The remainder of the Canal will be plugged under the same Contract. Both of these features will serve to prevent drainage by the Canal. The east-west feeder canal is actually a borrow canal that will be plugged as part of the Recommended Plan of the C-111SC Western project. The plugs should serve to prevent seepage losses from the Aerojet Canal. The features that have been proposed for the L-31E Canal are intended to provide learning opportunities for the future Eastern project while at the same time providing a "jump-start" for restoration in this area of project. The limited features that are

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			the South Dade and C-111 SC projects to prevent groundwater losses eastward from the Aerojet feature 3) NPS recommends that the additional plug be installed in the L31E, as it will provide additional benefit with low cost. 4) Within the project, overdrainage of the Model Lands by the Card Sound Road canal could also be reduced at relatively low cost. NPS recommends that plugs be installed in this canal, one north and one south of its junction with L31E, as part of the recommended project.	proposed will guide further restoration features such as the possible construction of additional plugs for the future-proposed Eastern project. The C-111SC Western project focused mainly on the restoration of Taylor Slough and its downstream areas; however, some limited restoration features were proposed in the Model Lands area. The features in the Model Lands area were mainly focused on elements that would provide a learning opportunity for future restoration efforts. It is likely that additional features such as the elimination of the drainage effects of any canals in the Model Lands will be addressed under the future-proposed C-111SC Eastern project.
DOI -4	Department of Interior	23-June-09	NPS considers C-111 canal stage a critical issue, since it controls wetland hydroperiods and thus the well-being of Taylor Slough and downstream Florida Bay. Lowering of operational canal stages on the eastern border of Everglades National Park is associated with increased seepage out of the Park, and with potentially detrimental drydowns within the Park and the South Dade Wetlands. This project should not result in any reduction in canal stage.	Any temporary reductions in C-111 Canal stage due to water withdrawals for the Frog Pond Detention Area and Aerojet Canal will be offset by the formation of the hydraulic ridge between ENP and the C-111 Canal, which is the main purpose of the proposed project.
DOI -5	Department of Interior	23-June-09	The effect of seepage losses from Everglades National Park is felt most strongly during the dry season, when marshes dry out early in the	The Draft Project Operating Manual has been crafted in the spirit of adaptive management that will allow project operations to be

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			season. Additionally, seasonal lowering of the water table affects Biscayne National Park resources. Reducing wet season canal seepage from the Everglades National Park, the Southern Glades and Model Lands, and operating the system to extend marsh hydroperiods in the entire project area into the dry season, should provide project benefits to both Parks.	optimized through the construction, testing, and implementation of the proposed project. All efforts will be made to maximize restoration efforts and mimic the natural, historical function of the ecosystem in the area, including extending marsh hydroperiods in certain areas while reducing seepage out of ENP to the fullest extent possible without harming other resources.
DOI -6	Department of Interior	23-June-09	Comments pertaining to the Water Quality section of Appendix C: 1) suggest using the full period of record for all data utilized in water quality analysis. 2) Revise the statement "insecticides and herbicides are sporadically found above detection limits in both surface and groundwater". The endosulfan surface water concentrations recorded at the S-178 monitoring station exceeded the chronic (0.056 ug/L) water quality criterion 42% of the time and exceeded the acute criterion (0.22 ug/L) 14% of the time during the 1987-2008 timeframe. Statistical trend analyses at S-178 show that endosulfan concentrations have not changed or are increasing in surface water and sediments, respectively. 3) The statement that atmospheric mercury loading was found to be more important than surface water loading is inconsistent with most scientific studies that attribute most mercury loading to atmospheric sources.	While the water quality data analysis presented in Appendix C does not include the latest water quality data it is representative of current WQ conditions within the basin. The Corps does not believe that incorporating new water quality data would result in different conclusions regarding the status of the basin water quality. However, the WQ appendix has been edited to reflect comments regarding frequency of endosulfan exceedances at S-178 as suggested by the commenter. The last comment regarding atmospheric mercury is not self consistent so cannot be addressed.

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DOI -7	Department of Interior	23-June-09	The Contaminated Soils section in Appendix A describes how soils from the new Frog Pond Detention Area will be used on-site for construction of berms, levies, or roads. We suggest describing methodologies that will ensure any reused contaminated soils will meet all required leachability criteria and will not pose a long-term threat to natural resources and water quality.	A Soil Management Plan is currently (June 2009) being drafted for the management of the impacted soils that will be excavated during the construction of the Detention Area. The plan details excavation, re-location and confirmation sampling activities. Additionally the soils will be placed such that they will not be in contact with any surface water. Currently leachability studies are being conducted for selected metals.
DOI -8	Department of Interior	23-June-09	Descriptions of the ecological benefits in the DPIR should be tempered by knowledge of the limitations of the model used in project design. It is recommended that language describing benefits to the marsh, to essential fish habitat and seagrasses, be accompanied by a description of the model weakness. Any additional, non-model based technical information that provides evidence for benefits or impacts of the project should be included and highlighted.	Section 5 and the Ecological Appendix of the PIR provide tremendous detail on the limitations of the hydrological model that was utilized to calculate environmental benefits of the proposed project. Additional analysis is also included in the Ecological Appendix in regards to observations made from estimated flows through structures.
DOI -9	Department of Interior	23-June-09	NPS concurs with the recommendation by the US Fish and Wildlife Service that further characterization of soil contaminants in the new Frog Pond Detention Area is needed to ensure mitigation efforts will reduce soil contaminant level below risk-based benchmarks for natural resources. Further evaluation of potential projects effects, via contamination levels, to the Everglades snail	Additional sampling has been conducted within the revised Detention Area footprint to characterize the soils, as has been done for soils within the original footprint. This data has been submitted to the Service and reviewed. The Service has concurred that these soils should be scraped and placed outside the footprint of the Detention Area. Confirmation soil samples following scraping activities are proposed in the

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			kite is warranted.	Soil Management Plan. The confirmation soil samples will be used to evaluate potential impacts to the wildlife and Service Trustee Species. The soil management plan as well as the confirmation soil analytical results will be submitted to the FDEP for review and concurrence.
DOI -10	Department of Interior	23-June-09	As part of the water quality mitigation efforts, implementation of an ongoing BMP program with the agriculture community is essential to reduce agrichemical contaminant sources to soil, surface waters, and groundwater in Taylor Slough, C-111 basin, Panhandle wetlands, and ultimately, Florida Bay.	A Best Management Practice program was considered during the study as a Pilot Project feature; however, after coordination with Policy experts, it was determined that the USACE does not possess the authority to implement a BMP program.
DOI -11	Department of Interior	23-June-09	In designing canal plugging and backfilling, reduction of source pools of exotic fish should be considered. In addition to plugs, canals adjacent to Everglades National Park should be shallowed sufficiently to reduce their potential as a source of exotic fish invasions into the Park.	Backfilling is not being proposed by the C-111 SC Western project; and the closest plug to ENP is in the Aerojet area. This project will not contribute surface flows to ENP; therefore, no exotic fish are expected to be introduced from surface water flows. The L-31W is being partially backfilled and plugged by the C-111 South Dade project.

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FOR CONTINUATION OF HOUSE DOCUMENT 112-132

CENTRAL AND SOUTHERN FLORIDA PROJECT:
COMPREHENSIVE EVERGLADES RESTORATION PLAN C-111
SPREADER CANAL WESTERN PROJECT

SEE VOLUME 3